

THE MARINE FISHES  
OF NEW YORK AND SOUTHERN NEW ENGLAND

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(Figs. 1-263 incl.)

PREFACE

The area considered herewith comprises shore waters from Chatham and Nantucket west to the New Jersey shore within 50 miles of New York City, and includes only those species that occur further in shore than the 25 fathom line.

Conditions on this stretch of coast are comparatively uniform. On the other hand they become abruptly more northern north of Cape Cod, and progressively more southern as one proceeds further south along New Jersey, where the shore trends north and south instead of east and west.

These are home waters for the writers. Here the marine fishes have been as thoroughly studied as anywhere in America, and it seems appropriate to make these studies available for ready reference by such a compilation as has been attempted.

The material is based primarily on earlier scattered publications by one or the other of the writers and on the following standard works; 1896-1900. Jordan and Evermann, *Fishes of North and Middle America*, Bull. 47 U. S. Nat. Mus.; 1913, Sumner, Osburn, and Cole, *Catalogue of the Marine Fauna*, in *Biol. Surv. of Woods Hole and Vicinity*, Bull. Bur. Fisheries, XXXI, part II; 1918, Nichols, *Fishes of the Vicinity of New York City*, *Am. Mus. Nat. Hist., Handbook*, Ser. No. 7; 1925, Bigelow and Welsh, *Fishes of the Gulf of Maine*, Bull. Bur. Fisheries for 1924, XL, pt. 1. All other readily available sources have also been used, such as various articles in "Copeia" (notes by Latham and others); articles in "Zoologica" and "Bull. N. Y. Zoological Soc.," and much material has been drawn from various publications of the U. S. Bureau of Fisheries by diverse authors, particularly that relating to life histories. A considerable amount of unpublished material which we had to hand, has also been utilized.

Practically all the records from Sandy Hook Bay since 1920 have been made as a result of the activities of the collecting boat of the New York Aquarium, the 'Seahorse.' Through its use the pound nets in that bay have been accessible in addition to the boat's own gear. Consequently, as the trips have been frequent, we feel that our knowledge of present day conditions in Sandy Hook Bay are particularly comprehensive.

Annotations under Woods Hole refer to that general vicinity, being taken from "Catalogue of the Marine Fauna" above referred to; annotations under New York refer to a fifty mile radius.

Aside from these sources a considerable amount of material has been furnished by Mr. Roy Latham of Orient, who has gone over all matter relating to that locality and added thereto from his unpublished observations. He has also furnished numerous varied items and should be credited as author of all Orient material.

For many years it has been expedient to follow the nomenclature of Jordan and Evermann (1896-1900. *Fishes of North and Middle America*) in faunal works of this sort. The large amount of work done in Systematic Ichthyology since 1900 renders this nomenclature less and less satisfactory, and such changes from it in generic names have here been introduced as are clearly indicated in Jordan's recently published "Genera of Fishes," the last volume of which was issued by Stanford University in 1920. Recent changes in specific names have been accepted or rejected in accordance with the writers' judgment. It should be stated furthermore that they do not follow the modern tendency to split genera into smaller and smaller units, believing this tendency to be unnecessary and transitory; and that they prefer to use a name which may not stand according to canons of nomenclature rather than one the identity of which might be questioned, for such purposes as the present at least.

A word as to arrangement: a descriptive paragraph is first given for each group of fishes—the group corresponding in almost every case to the family as recognized by Jordan and Evermann. Where more than one genus occurs within our region in a given group, a key to the several such genera, which we believe will prove of service in differentiating them, follows. When several members of a genus occur a few words of description to aid in their differentiation follow the name of each species. It is without the scope of this work to present an adequate descriptive treatment of the fishes considered, but it is believed that such descriptive matter as is given will aid the amateur ichthyologist in placing species as they come to hand. Care has been taken in the selection of the single popular name of each fish used. Popular nomenclature develops along the lines of the English language, unhampered by codes which determine technical names; but although popular names are theoretically more subject to change than technical names, it is useful that they should be standardized so far as the nature of the case will permit.

The text figures, are intended to supplement the scanty keys and descriptions as an aid to identification. They should be considered more as character sketches than as detailed drawings. All available sources have been drawn on as bases for these figures, and several had to be made from actual specimens. It is rather strange that this is the first attempt to figure every species from this area; adjacent to the greatest center of human activity.

The opening paragraph under each species, entitled Distribution, gives the status and migration dates so far as is known within our region, and



this is followed by a similar statement of the fish's status at the three localities, Woods Hole, Orient and New York. To repeat: Annotations under Woods Hole refer to that general vicinity and have been taken from the "Catalogue of the Marine Fauna," 1923, Sumner, Osburn and Cole, above referred to. Annotations under New York refer to a fifty mile radius and are those found in "Fishes of New York," 1918, Nichols, revised and brought up to date. The data from Orient, as we have said, is furnished by Latham, either directly or indirectly.

Next follows a paragraph giving the general range of the species, which in turn is followed by one or more paragraphs of a general nature, relating to habits, economic use, or philosophic discussion.

The material under Life History, comes next, and a final statement gives the maximum size of each fish so far as data is at hand. This latter is given in inches, but the measurements of fish eggs and young fish are so much better expressed in millimeters, that for them we retain the technical, less familiar metric system. The accompanying scale (on fly leaf) compares the two systems.

It has seemed to the writers essential that both the New York Aquarium and the Department of Ichthyology of the American Museum of Natural History have a book of this sort on the marine fishes of New York available for ready reference, to answer the numerous queries constantly received from fishermen and others. It is the writers' purpose also to place it in the hands of the public in such form that by its aid they can answer these queries for themselves. It is furthermore believed that it will be of value in directing attention to what is still unknown about fishes near home and stimulate a study of them.

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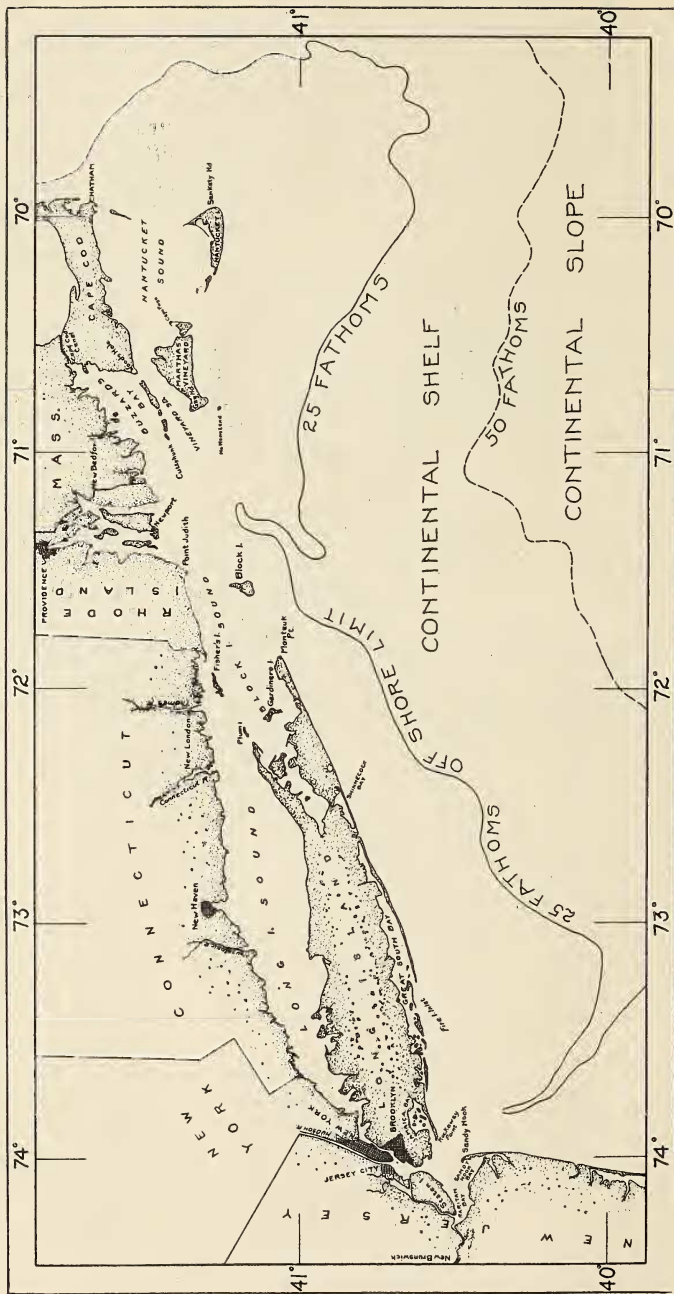


Fig. 262. Sketch chart of New York and Southern New England. The region treated extends from Chatham, Massachusetts (to the east) to fifty miles south of New York City on the New Jersey shore (to the west). The twenty-five fathom line (solid) marks its off-shore limit; a broken line at fifty fathoms showing the edge of the continental shelf beyond.

# INTRODUCTION<sup>1</sup>

## ASPECTS OF THE STUDY OF FISHES

Ichthyology, or the scientific study of fishes, like that of any other group of animals, may be roughly divided into three aspects, Systematic, Economic and Philosophic.

Systematic Ichthyology deals with defining, naming and classifying fishes. It is a very necessary preliminary to every other branch of the subject, without which our knowledge would fall into the utmost confusion. The most satisfactory system which has been devised for assigning technical names to fishes (as indeed to all animals and plants), and the one universally followed, is to combine two names, the first or generic name shared by the kinds most closely related, the second or specific name diagnostic of the one which bears it. The generic name is always spelled with a capital, the specific name with a small letter.

Economic Ichthyology is the study of fishes in relation to human welfare, and its most important branch naturally is concerned with their use as food—fisheries, fish-culture, etc. Few people realize on what a large scale fish-culture, fish-farming it might be called, is carried on. In the year ending June 30, 1917, the United States Bureau of Fisheries distributed roughly three hundred nineteen millions of fish eggs and four thousand seven hundred thirty millions of young fishes to be planted in various waters.

Philosophic Ichthyology concerns itself with the fish and its place in nature, the broadest and purest aspect of the science. It follows the evolution of fishes by the evidence of fossil records from early periods in the earth's history to the many specialized forms of the present day. It examines the wonderful correlations existing between the habits and structures of fishes. In fact its possibilities and ramifications are without limit.

The series of vertebrate (back-boned) animals from fishes to man is characterized by an increasingly complicated structure, and increasingly complicated environment for the individual to react to, and an increasingly complicated mentality. Fishes doubtless possess the simplest, lowest type of vertebrate mind. A great deal of their behavior can be explained as reflex action, a definite stimulus followed by a definite response. The bass sees a glittering minnow and strikes at it. An artificial minnow affects him similarly and he reacts towards it in the same way. One of the most complicated mental phenomena we have observed in fishes was illustrated by two porgies in a tank at the New York Aquarium. One of these had a bullying attitude, the other one a cringing attitude. From time to time the former would dart in the direction of the latter, which would slink away in evident alarm. Though the difference in size between the two was insignificant, clearly the former was ruling the tank, and they both knew it, that is, each one was adjusted mentally to reply to stimuli in a way appro-

<sup>1</sup> Taken largely from "Fishes of New York," 1918.

priate to the rôle he was playing. A parallel human situation would be associated with definite emotional states of mind, whence we may argue that the fish is capable of such. As a matter of fact, as is well known to aquarists, the first of two fish to be introduced in a tank is likely to lord it over subsequent arrivals, and very probably in this case the more aggressive individual was so by reason of such seniority.

#### HOW TO DESCRIBE AND IDENTIFY FISHES

The first problem which faces the student of fishes is to differentiate between the many species. The sea is large, and thousands of distinct species of fishes find a place in it. Fresh waters, especially those of the cold and temperate north, harbor a comparatively small number. The species vary in every conceivable particular from the minute structure of their bone and the form of the internal organs to the proportions of the body or the number of rays in the fins. A few simple characters and proportions are customarily used in comparative descriptions of fishes, and it is necessary to master these before a specimen can be properly identified, that is, assigned to the name by which it is known in literature. All measurements are taken in a straight line, as with a pair of dividers. A fish's standard length is by custom the distance from the tip of the snout to the base of the tail fin; the total length extends this distance to the tip of that fin. Its depth is the greatest vertical distance from the upper to the lower contour of the body, exclusive of fins. The length of the head is measured from the tip of the snout to the most posterior point on the border of the gill-cover exclusive of spines which may project still further backward. The eye measurement is the greatest diameter of same. The maxillary measure is taken from the tip of the snout to the posterior end of the maxillary, or movable bone at the side of the upper jaw. The interorbital is the least distance between the eyes across the top of the head. The snout is measured from its tip to the front of the eye. These absolute measurements are of little value, as a fish's size is not fixed (unlike the size of a fully feathered bird, for instance, which is constant within a few millimeters for a given species), and a given species of fish may vary considerably in size, even when full-grown, dependent on the waters it inhabits, the amount of food it has had available, and other factors. It is the proportions between the different measurements that are fairly constant within a given species, and which we rely upon for making diagnoses. The larger measurements, as the length of the head and depth of the body, are stated according to the number of times they are contained in the standard length of the fish, and similarly the smaller measurements, as that of the eye or maxillary, according to the number of times they are contained in the head. The fish's anterior paired fins are known as the pectoral fins. They may be placed on the lower surface, on the side behind the head, or at the throat. The posterior paired fins are the ventral fins. A median fin behind these is the anal fin. One, two or more fins in the mid-line of the back are known respectively, beginning with the anterior one, as the first, second and third dorsal fins. The fin at the end of the tail



(which may be pointed, rounded, square or forked in outline, and is occasionally unsymmetrical) is the caudal fin. The number of supporting rays in a particular fin are important in the diagnosis of a fish, as their number is constant within narrow limits of variation, in any one species, somewhat as a normal man has five fingers and toes, no more, no less. These rays may be divided into two classes. First, spines, solid, rigid and sharp-pointed. Second, soft rays, more or less split or branched terminally, jointed and flexible. It is customary to distinguish between the two by using Roman numerals for the spines. Dorsal X, 14 means a dorsal fin with ten spines followed by fourteen soft rays. Dorsal X-14 would mean two entirely separate dorsal fins, the first of spines, the second of soft rays. The lateral line of a fish is a series of pores, usually one on a scale, beginning at the shoulder and ending at the base of the caudal fin. It may be straight or variously curved, complete, (if it covers the entire distance) or incomplete, and is sometimes duplicated, or broken in the middle, or lacking altogether. The number of scales is of course, in inverse ratio to their size, and is written thus: 5-32-8, which signifies five horizontal rows between the lateral line and base of first dorsal fin, thirty-two more or less obliquely vertical rows crossing the lateral line, and eight horizontal rows between the lateral line and anal fin; or the scales may be counted from lateral line to ventral (or pelvic) fin, and so stated.

There is a regrettable lack of good popular books which will be of service to the amateur in identifying fishes. Almost the only comprehensive work, the "Fishes of North and Middle America" by Jordan and Evermann, in four volumes, is too technical and too bulky. A comparatively small number of species of fishes occur in one locality. It is hoped that the grouping, keys and few words of description of related forms given will aid the average saltwater fisherman to name correctly such as may come into his hands.

Learning the name our predecessors have given a fish is necessary to an intelligent understanding of what is known about the species. As has previously been pointed out, however, this is only a first step, which should not be an end in itself to the student, but only a means. After the fishes have been identified the whole field of research in either economic or philosophic ichthyology lies before him. The data here presented make apparent the great gaps in our knowledge of even our more common species. It is not necessary that a profound technical training be present for a background to advance the science. Many useful things are continually being uncovered by persons little equipped with scientific methods. For instance the sizes of young fish when taken serially for a period of a few months, each collection being averaged, gives a fair index of the growth rate. The proportion of males to females at any given date is useful, the stomach contents, record of individuals of abnormal size or coloration, and so on, add information. This information, turned over to some responsible institution, will be recorded for the common good.

The lack of data under any species indicates that we do not know of any from personal work or published records, and therefore the same is desirable.

## CLASSIFICATION OF FISHES

The dominant type of modern marine fish resembles a perch or bass. It has a large mouth, short body, and spines in the fins, particularly in the back (or dorsal) fin (which either has the anterior part made up of spines or else is divided into two separate fins, the first of which is spiny).

Probably the majority of species which exist to-day, in salt water, are of this type. In attempting to sort out or classify the remaining species, we can make out first, a more or less complete series of forms from the most primitive fish, the sharks, leading up to the perch type, and secondly, several divergent lines of development leading away from this series into still more highly specialized or more or less degenerate series. The lampreys have little relationship with any of our other fishes. Many students claim that they are not, in the true sense of the word, fish at all. The sharks and rays stand somewhat less apart from the remaining species, all of which differ from them in having the cartilaginous structures more or less replaced by bone, and all of which may be placed in the comprehensive group known as *Teleostomi*. The ganoid fishes (for example the Sturgeon) stand apart as being more cartilaginous than other *Teleostomi*, all of which belong in the major group known as *Teleostei*. There is a rather evident connection between the ganoid fishes and the herring and trout group, and the true eels seem to be degenerated derivatives from the herring-trout group. Just where the catfish group should come in is open to question. We follow the conventional treatment in placing them before the herrings and trouts, though very probably it will be proved that they are really more recent than these. Between these primitive fishes and the forms which begin to approach the perch, the line of ascent is obscure and broken, though the killifishes and a variety of specialized forms such as needlefish, stickleback, pipefish, doubtless belong to this section of it.

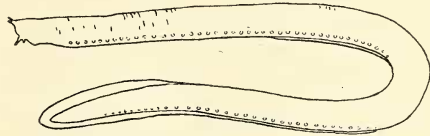
The so-called *Acanthopteri* are spiny rayed fishes including the dominant perch, bass group, and all those forms with clearly traceable relationships to it; as the mullets, etc., related to its probable immediate ancestors; or the derivative mackerel-like fishes (an adaptation to wide ranging habit over open seas). Another clearly marked line is through the angelfish (beginning with the wrasses, which, superficially at least, are more perch-like than the mackerels, ending with the very un-perch-like plectognath fishes, which might be considered the apex of specialization in fish life). The sculpin-like or mail-cheeked fishes, although a well-marked group, have certain members of sufficiently perch-like character to show their derivation. The gobies, blennies, etc., are probably one or several lines unrelated to this one, although it is conceivable that they arose through more or less sculpin-like forms. At the other end of this series there is an approach to the cod-fishes. Recent investigation and recently discovered fossils have shown that the very remarkable flatfishes were derived rather directly from perch-like fishes. The final section, the frog fishes, would seem to have been evolved from perch-like ancestors, either directly or through sculpin, blenny or goby-like forms.

## HAGFISHES.

Excessively slimy, eye-less, eel-like fishes, with a round sucking mouth about which are several barbels; teeth on roof of mouth and tongue.

## 1. Slime Eel

*Myxine glutinosa* Linnaeus



DISTRIBUTION: *Woods Hole*. Crab ledge, occasionally drawn up on cod-fish bait. Although this locality is actually beyond our region, it is so close to the line that the species is included.

Occurs on both coasts of the North Atlantic in rather deep water; from Arctic seas south to the latitude of North Carolina at a considerable depth.

"The hag [slime eel] is not a true parasite, as has sometimes been suggested, there being no reason to believe it ever attacks living, uninjured fish, but it is a scavenger. Judging from its habits during the brief time it survives in aquaria, it spends its time lying embedded in the clay or mud with the tip of the snout projecting, but it is an active swimmer. Probably it finds its food by its greatly specialized olfactory apparatus. So far as is known it feeds chiefly on fish, dead or disabled, though no doubt any other carrion would serve it equally well, were such available. It is best known for its troublesome habit of boring into the body cavities of hooked or gilled fishes, eating out first intestines and then the meat, finally to leave nothing but a bag of skin and bones, inside of which, or clinging to the sides of a fish it has just attacked, the hag itself is often hauled aboard. In fact, it is only in this way, or entangled on lines, that hags ordinarily are taken or seen. Being worthless itself, it is an unmitigated nuisance and a particularly loathsome one, owing to its habit of pouring out slime from its mucus sacs in quantity out of all proportion to its small size. One hag, it is said, can easily fill a 2-gallon bucket, nor do we think this is any exaggeration."

"The hag is at home only in comparatively low temperatures—cooler, probably, than 50°—and this confines it to depths of 15 to 20 fathoms or more in the Gulf of Maine in summer."—Bigelow and Welsh.

LIFE HISTORY: It has been claimed that this species is normally hermaphroditic. It is reputed to be male up to a size of about 33 cm. and on exceeding that size to produce ova. This hypothesis of hermaphroditism has been questioned, but is quite generally accepted.

The eggs are large (up to  $\frac{4}{5}$  of an inch long), oval, tough shelled, few

(about 2 dozen), with a cluster of barbed filaments at each end. They have been found in from 50 to 150 fathoms, are demersal, and stick fast in clusters to some fixed object. There is no larval stage unlike the adult.

SIZE: Reaches a length of 18 inches.

### LAMPREYS.

Eel-like fishes with a round, sucking jawless mouth (armed with concentric rows of teeth) slanting somewhat backward across the entire front of the head. Eyed moderately developed. Seven small holes or gill-openings on the side of the neck below and behind the eye.



#### 2. Sea Lamprey

*Petromyzon marinus* Linnaeus

DISTRIBUTION: Adults (or young recorded in salt water) March to December 12. *Woods Hole*, adults April to June. *Orient*, April 15 to December 12; always rare; adults May and June; post-larval young (121 mm.) Nov. 19 to 27. *New York*, not uncommon, March to December 10, one of 6 $\frac{5}{8}$  inches May 11 (*Sandy Hook Bay*).

Occurs on both coasts of the Atlantic, south on the American Side to Chesapeake Bay, rarely to Florida. Enters streams from the sea to spawn.

Lampreys are strong vigorous swimmers. They suck on to the sides of larger fishes with their peculiar mouths, rasp through skin and scales with their teeth, and suck the blood. Cod, haddock, and mackerel are known to be attacked in this manner.

LIFE HISTORY: Adults enter streams to spawn in spring or early summer, as late as June 17 at the eastern end of our area. A circular nest is constructed in the stream bottom by seizing the larger stones in the mouth and removing them. Over this nest pairing takes place and in it the minute eggs are laid; 236,000 ova have been found in an individual sea lamprey. They spawn but once and then die. The larvae lack eyes and teeth. The time and condition in which they enter salt water is uncertain.

Large numbers of ripe lampreys are to be seen each spring in the *Swimming River* a few miles inland from *Sandy Hook Bay* through which they must pass in their migration from the sea. In 1923 the first run was noted on March 28 (March 25, 1925) and the last laggard was seen on May 20. The peak of the season this year was about May 8. Generally, however, it occurs in the latter part of April.

SIZE: Adults are 2 to 3 feet long; largest at *Orient* 27 inches.

Examination of 98 examples from the *Swimming River* showed the maximum to be 33 inches long and 2 pounds 4 ounces in weight, the minimum to be 24 inches long and 14 ounces in weight, whilst the average had a length of 29 inches and a weight of 1 pound 11 ounces.

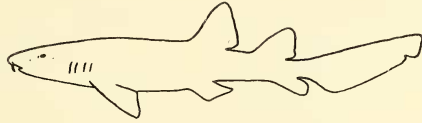


## NURSE SHARKS

Large sharks with very hard rough skin, blunt head. Mouth small, with a fleshy barbel at each corner of a quadrangular flap in front of the mouth. Two back fins of about equal size, and placed far back, the first above or behind the ventrals.

## 3. Nurse Shark

*Ginglymostoma cirratum* (Gmelin)



**DISTRIBUTION:** A specimen of this shark is reported by H. S. Champlin from a fish pound at Pt. Judith, Rhode Island, summer of 1920. As he is familiar with the Nurse Shark in Florida and nothing else resembling it occurs on the coast, the record is credible.

Occurs in warm seas of the western hemisphere from the capes of the Carolinas (rarely) to the South Atlantic coast of Brazil, also on the west coast of Mexico.

This is a sluggish, harmless shark with no apparent protection against its rapacious kin but the toughness of its hide. Harpooners say that although it is comparatively easy to put an iron into a Nurse Shark at the first blow, if that is not successful they seem to "set" their hide, which then becomes well-nigh impenetrable.

**FOOD:** Feeds on squid, shrimp, etc.

**LIFE HISTORY:** A female on July 22 (North Carolina) contained 28 eggs, about as large as a goose's egg with a delicate horny shell. It is believed that these eggs are retained for the entire incubation period, and free young released as in the Requiem Sharks. Such being the case, the nurse shark presents an interesting transition stage from those elasmobranchs (shark-like fishes) which deposit large eggs with a horny shell, as do our skates, to those which bring forth living young.

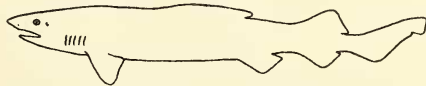
**SIZE:** Reaches a total length of from 6 to 10 feet.

## FALSE CAT-SHARKS

A single species known, a large shark with the gill-openings all in advance of the breast fin, the first back fin long and low, highest posteriorly. Jaws with many rows of small, three-pointed teeth.

## 4. Small-toothed Shark

*Pseudotriakis microdon* Capello



**DISTRIBUTION:** Two specimens only of this species known, the first from Portugal; the second, 10 feet in length, came ashore at Amagansett, Long Island.

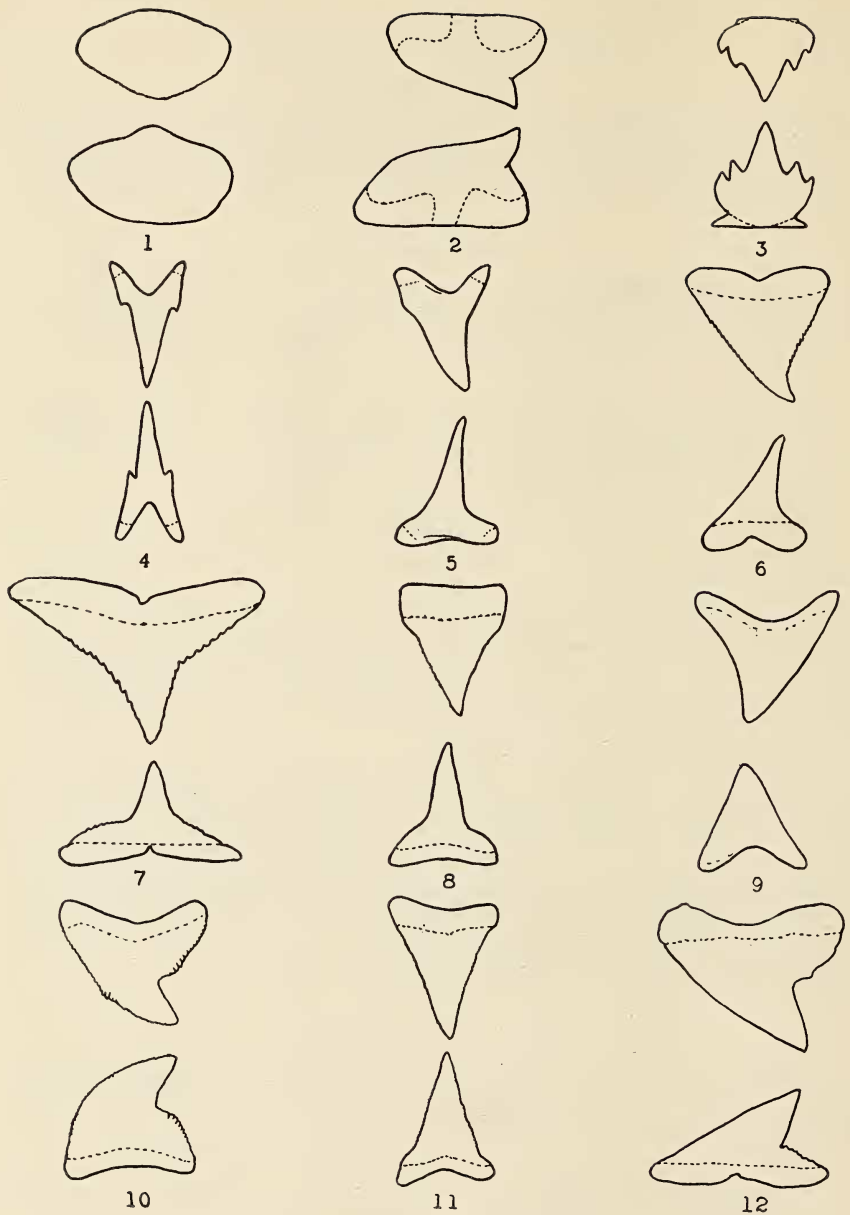


Fig. 263. Shark Teeth; an upper and lower tooth to the left of the symphysis. Those of the basking shark, (*Cetorhinus maximus*) and the small-toothed shark (*Pseudotriakis microdon*) are omitted because of their extreme small size and the ready distinction of the two species. 1, smooth dogfish, *Mustelus canis*; 2, spined dogfish, *Squalus acanthias*; 3, nurse shark, *Ginglymostoma cirratum*; 4, sand shark, *Carcharias littoralis*; 5, mackerel shark, *Isurus tigris*; 6, blue shark, *Prionace glauca*; 7, spot-fin ground shark, *Carcharhinus limbatus*; 8, New York ground shark, *Carcharhinus milberti*; 9, thresher shark, *Alopias vulpes*; 10, tiger shark, *Galeocerdo tigrinus*; 11, man-eater shark, *Carcharodon carcharias*; 12, hammerhead shark, *Sphyrna zygaena*. Eight may equally well stand for the dusky (*Carcharhinus obscurus*) or the Southern ground shark (*C. commersonii*).

## REQUIEM SHARKS

Sharks with moderately developed, unsymmetrical caudal fin, the upper lobe always much the longer. Caudal peduncle not notably keeled. Two back fins without spines; the anterior over or before the center of the body; the posterior usually much the smaller. Teeth various, never long and pointed with basal cusps.

- a. Teeth small, paved, not sharp. Lower surface flat. Two back fins of about equal size.

*Mustelus*

Teeth larger, flat and sharp (see b).

- b. Teeth large, semicircular, coarsely saw-edged, with points turned obliquely outward, those of the upper jaw identical with those of the lower. A large shark with heavy blunt head and tapering body, usually striped or spotted.

*Galeocerdo*.

Teeth more or less finely saw-edged, the lower teeth more or less narrower than the upper. Fins sometimes tipped and edged with black but body unmarked. Second back fin much smaller than the first. (see c).

- c. First back fin inserted posteriorly nearer ventral than pectoral fins. A long, slender off-shore shark, bright blue above, white below.

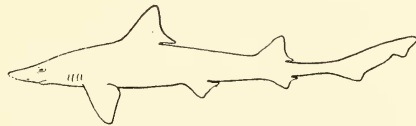
*Prionace*

First back fin inserted anteriorly, nearer pectoral than ventral fins.

*Carcharhinus*

### 5. Smooth Dogfish

*Mustelus canis* (Mitchill)



**DISTRIBUTION:** A summer resident in our region. Recorded from May 2 to December 13. As it appears to the eastward (Woods Hole and Orient) in May, is said to be most abundant at Woods Hole in June, and to the westward is recorded somewhat later and in some years not abundant until fall in Sandy Hook Bay, it may approach from the sea in the spring and leave to a greater extent along the shore to the southwestward in the fall. *Woods Hole*, May to November, but most abundant in June. *Orient*, May 2 (1908) to November 28, average for first one taken in 15 years May 10. Immature individuals may be frequent until early in December. *New York*, common, June to December 13. Some years common throughout the season in Sandy Hook Bay; others not abundant until fall. An exception among our summer fishes in being also European.

Occurs abundantly on the warmer Atlantic coasts of Europe and America from Cape Cod to Cuba, a very rare straggler north to the Bay of Fundy.

The smooth dogfish is abundant in all salt waters near New York City in summer, and is found in shallow waters on all sorts of bottoms, bays of

of the Sound as well as the sea. Swims near the bottom, singly, though sometimes in considerable numbers at favorable points.

Food: Varied, but crustacea preferred,—lobsters, crabs, shrimps, etc. Also fishes of almost any sort, squid, annelids, amphipods, small gastropods. It hunts largely by scent, feeding mainly on crabs, and its teeth, which are small, numerous, and blunt, to deal with this kind of food, are unlike those of any other shark. It is not particular in its diet, however, and may be caught with almost any live or dead bait, being frequently taken by anglers in pursuit of other fishes. Though little used, its flesh is nutritious and palatable, as it may well be, for among the smooth dogfish's favorite food are young lobsters and the blue crab.

LIFE HISTORY: Females containing eggs and embryos taken throughout the summer. At Woods Hole, Bumpus believes there are probably two broods in June and August respectively, and the capture of females containing embryos is reported as late as about September 25. Number of young reported as high as 27, usually 4 to 12. In a 54 inch female, young reported as 14 inches in length.

SIZE: Reaches a total length of  $4\frac{1}{2}$  or 5 feet; over 3 feet exceptional. The majority of examples of this species taken in Sandy Hook Bay are immature. Females generally outnumber males about 3 to 2 in the pound nets. The average, maximum and minimum of the lengths and weights of 24 examples taken from that Bay during the first half of July, 1923, are given below and may be taken as representative of the locality.

<i>Length</i>	<i>Weight</i>
Maximum $28\frac{3}{4}$ inches	2 pounds 12 ounces
Average $22\frac{3}{4}$ "	1 " 6 "
Minimum $14\frac{3}{4}$ "	0 " 6 "

The largest example from Sandy Hook Bay measured about 47 inches in total length and weighed  $14\frac{1}{2}$  pounds. It died in the N. Y. Aquarium, September 21, 1925, after being in captivity about one year during which it gave birth to 5 young.



### 6. Tiger Shark

*Galeocerdo tigrinus* Müller and Henle

DISTRIBUTION: Probably present in our region every season in varying small numbers, August to October, the ocean, Vineyard Sound and Buzzards Bay. *Woods Hole*, occurring from August to October, rarely before August. *New York*, casual in late summer and fall (September 11).

Occurs generally distributed in tropical seas. Abundant in the West Indies; a few north to Cape Cod.

FOOD: This large, rather sluggish shark has been found at Woods Hole to feed on menhaden, bonito, squid, etc. More detailed studies of its food

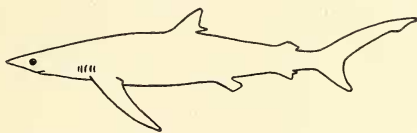


in southern waters show it to be practically omnivorous, feeding on big sea turtles, smaller sharks, carrion, and almost anything else.

**SIZE:** Reaches a length commonly of 11 or 12 feet, weighing five or six hundred pounds, and rarely a length of about 30 feet.

### 7. Blue Shark

*Prionace glauca* (Linnaeus)



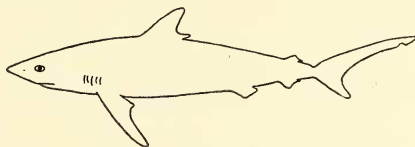
**DISTRIBUTION:** Very rare. July to late October. *Woods Hole*, several reported July and August. *New York*, a large one taken near City Island in late October, 1911.

A large shark of warm seas, pelagic, only occasionally taken on the coast of America, where there are records from as far north as Nova Scotia.

**SIZE:** Average adult about 12 feet long.

### 8. Dusky Ground Shark

*Carcharhinus obscurus* (Le Sueur)



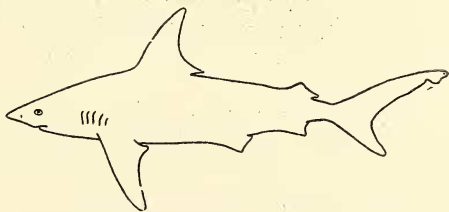
Upper teeth triangular, much broader than the lower. Snout moderately blunt. No ridge on the back. Second dorsal fin smaller than anal and placed over it; length of front of dorsal fin contained more than three times in its distance from snout.

**DISTRIBUTION:** There is some confusion as to the identity of sharks of this genus. At *Woods Hole* *obscurus* and *milberti* have been generally confused under the name *obscurus* and are reported from there June 1 into November. *Orient*, young of 22 to 32 inches, September 17 to November 1.

**Food:** Lobsters, crabs and fishes (menhaden and weakfish).

### 9. New York Ground Shark

*Carcharhinus milberti* (Müller and Henle)



Upper teeth triangular, much broader than the lower. Snout not blunt. A ridge on the back. Second dorsal fin not noticeably smaller than anal and placed about over it; length of front of dorsal (origin to tip) contained less than twice in its distance from the snout in adult.

**DISTRIBUTION:** Common in bays of the ocean side of Long Island, mid-June to mid-September; almost all adult females, which apparently enter these inshore waters for the purpose of having their young. *Woods Hole*, of uncertain abundance, breeds. An old record (1873) refers to some other species. *New York*, almost all adult females mid-June to mid-September. Young (up to about 3 feet) July 15 to October 19 (Sandy Hook Bay).

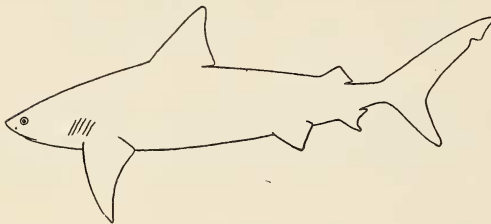
Due to the difficulty in checking up descriptions of sharks of this genus, the extra-limital range of *milberti* is uncertain. We have never seen it in the southern states.

Mr. Edwin Thorne of Babylon has secured extensive data on this shark. Females are common in the bays, present between the middle of June and the middle of September; males, very rare—seen only in August.

**FOOD:** Consists of various bottom fishes, the winter flounder, *Pseudopleuronectes*, largely predominating, and an occasional weakfish, dogfish, eel or crab.

**LIFE HISTORY:** Females carrying young taken in Great South Bay from June 22 to August 5. Young number 8 to 11, neither sex greatly predominating. When released they are about 22 inches long and weigh  $2\frac{1}{2}$  pounds. One of about 3 feet seen in Sandy Hook Bay as early as June 9 may have been of the preceding year. In September, 1924, five ranged from  $24\frac{7}{8}$  inches to 26 inches in total length.

**SIZE:** Adults range from a little under  $5\frac{1}{2}$  to 7 feet 8 inches total length, weighing between 75 and 200 pounds.



10. Southern Ground Shark  
*Carcharhinus commersonii* Blainville

Upper teeth triangular, much broader than the lower. Snout very blunt. No ridge on the back. Second dorsal fin inserted distinctly in advance of anal; length of front of dorsal twice or a little more in its distance from snout.

**DISTRIBUTION:** Males uncommon in the bays of the south shore of Long Island in late summer (August, earliest August 4). *Woods Hole*, status uncertain due to confusion with related species. Photographs examined of half-grown males a little over 5 feet total length,—taken August 20. *New York*, males uncommon in late summer.

Occurs in warm waters of the Atlantic on both coasts.

**FOOD:** Inhabits coastal waters feeding on fish, large crustacea, smaller sharks and rays. Common about wharves, where it picks up refuse; seldom shows itself at the surface but is readily taken on a baited hook.

**LIFE HISTORY:** The young number about 6. On the coast of Florida they are released in spring.

**SIZE:** Adults are 8 to 8½ feet total length and weight between 250 and 375 pounds, reaching a length of 10 feet and a weight of 400 pounds (a male, North Carolina).

### 11. Spot-fin Ground Shark

*Carcharhinus limbatus* (Müller and Henle)



Upper teeth narrow, little broader than lower. Fins usually sharply black-tipped.

**DISTRIBUTION:** Occasional in mid-summer. *Woods Hole*, 1875. At least twenty specimens during the summer of 1878. Babylon, Long Island, July 14, 1910. Easthampton, L. I., a large male, August 7, 1916 (W. Hel-muth). Sandy Hook Bay, July 24, 1924, a male 35¼ inches in total length.

Occurs in tropical and sub-tropical seas, cosmopolitan. Abundant in the West Indies and Florida. Common north to the capes of the Carolinas.

**LIFE HISTORY:** Females are with young which measure about 22 inches in total length, almost ready to be released in April in the Bay of Florida. The young number 3 to 6, may be of either sex or equally divided, females apparently somewhat predominate. No adult males are present in the same waters with the pregnant females at this season.

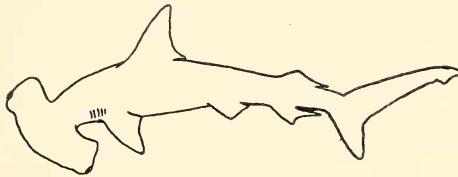
**SIZE:** Breeding females in Florida are between 5 and 5½ feet total length. Easthampton, male, 6 feet 4 inches.

## HAMMERHEAD SHARKS

A specialization of the Requiem Shark type wherein the head is depressed and expanded laterally. The eyes situated at the apices of the lateral expansion.

### 12. Hammer-head Shark

*Sphyrna zygaena* (Linnaeus)



**DISTRIBUTION:** Small individuals up to about 6 feet, rather common, July 14 to November 22. Mostly July and August. *Woods Hole*, July and October. *Orient*, one 22 inches in length, November 22. *New York*, not uncommon, mostly small examples of about 2 feet, July 14 to October 14.

Occurs in all warm seas, from Cape Cod southward on our coast. Oc-

asionally seen swimming at the surface with caudal and dorsal fins projecting. The hammerhead is a slender, active and swift-swimming shark. The most reasonable function that has been attributed to its peculiar head is that of a bow-rudder, to increase its dexterity of motion.

FOOD: Fish and squid.

LIFE HISTORY: The young of this species are in large number; 37 embryos have been taken from a female of 11 feet. Probably those adult individuals which reach our waters in summer give birth to their young at that season, due to the small size of young frequently taken here. Sandy Hook Bay, July, 1924, 3 ranged from  $23\frac{1}{4}$  to  $25\frac{3}{8}$  inches in total length.

SIZE: Reaches a total length of 17 feet, and estimated weight of 1500 pounds.

### THRESHER SHARKS

Sharks with the upper lobe of the caudal fin narrow and greatly elongate, as long as the body of the fish.



13. Thresher Shark  
*Alopias vulpes* (Gmelin)

DISTRIBUTION: Common to the eastward, Buzzards Bay, etc. Uncommon to the west. April till late in the fall. *Orient*, two recent records, June 20, 1910, and August 12, 1912, formerly less rare. *New York*, occasional, April; July 24, 1918, Islip.

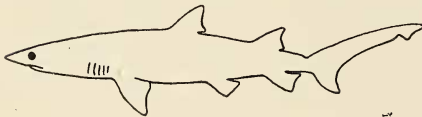
Occurs in all warm temperate seas, especially the Mediterranean, north on our coast abundantly to Block Island and rarely to the Gulf of St. Lawrence.

A surface swimmer. The thresher shark's elongate tail is not sufficiently rigid or muscular to strike an efficient blow. These sharks are said to swim round and round a school of small fish herding them into a narrow compass where they can be readily attacked, and in this sort of hunting the tail should be an asset, even aside from striking and disabling the fish, as has been reported.

FOOD: Fish, especially schooling surface species such as mackerel, menhaden and herring.

SIZE: Reaches about 20 feet total length, 15 feet not uncommon, one of 13 feet weighed about 400 pounds.

### SAND SHARKS



14. Sand Shark  
*Carcharias littoralis* (Mitchill)



DISTRIBUTION: May 27 to November, common. *Woods Hole*, June to November. *Orient*, May 27 (1908) to October 21. *New York*, common, June 13 to October 4.

Occurs commonly between Cape Cod and Cape Hatteras, stragglers north to Maine. Very like if distinct from the European *C. taurus*.

SIZE: Local specimens usually 5 feet or less in total length, but there is a record from Clinton, Conn., of 8 feet 10 inches, with estimated weight of 250 pounds.

### MACKEREL SHARKS.

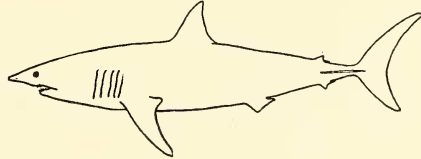
Swift and powerful sharks of more or less off-shore habitat, with the tail lunate, upper lobe only slightly longer than lower. Peduncle keeled. Teeth large, pointed, varying in shape, sometimes with basal cusps.

Teeth long, narrow and pointed without saw edges

*Isurus*

Teeth large, triangular, saw-edged, the same above and below. *Carcharodon*

#### 15. Mackerel Shark *Isurus tigris* (Atwood)



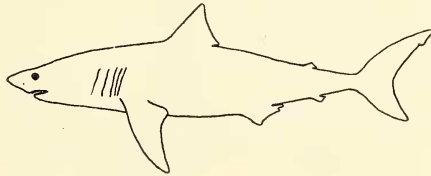
DISTRIBUTION: Fairly common to the eastward, Buzzards Bay, Vineyard Sound; two reports to the west. September 11 to December. *Woods Hole*, most numerous in the fall. Taken in December. *Orient*, October 2, 1910, Sound. *New York*, casual, September 11 (1918, R. C. Murphy) to October.

Occurs from Maine (rarely), to the West Indies.

An off-shore fish which very probably seldom or never enters shallow bays or even Long Island Sound. Probably regular enough in the ocean, but seldom reported. The lunate tail and narrow, keeled peduncle of these swift, wide ranging off-shore sharks, parallels that of the mackerel-like fishes of similar habit, and for that matter of the whales and porpoises:—in a horizontal plane (cetacea), as opposed to vertical plane (fishes). It is doubtless the most advantageous form for swift continuous swimming.

SIZE: Reaches 10 feet or more. A 7 feet 4 inch (total length) specimen from *Orient*.

#### 16. Man-eater Shark *Carcharodon carcharias* (Linnaeus)



**DISTRIBUTION:** Casual. *Woods Hole*, reported by Baird in 1871, and two, June 17 and 25, 1903. In northern New Jersey and near New York City, it was present from June to July 14, 1916, but whether more than one individual is uncertain.

Occurs cosmopolitan in tropical and sub-tropical seas, apparently everywhere rare, on our coast accidental north to Eastport, Maine.

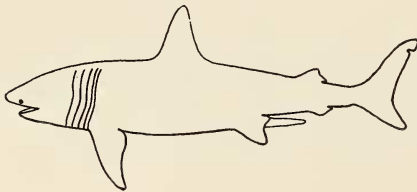
The man-eater or white shark is the largest member of the particularly swift swimming voracious group of mackerel sharks. The largest specimens are lead-white in color,—the smaller ones are dark above and white below. It is one of the largest, most powerful of existing fishes. Dr. Jordan tells of finding a fair-sized young sea-lion, whole, in the stomach of one of about 30 feet. Certain individuals, at least, are dangerous to bathers, and it is fortunate that, even in the tropics, the species is almost everywhere rare.

**FOOD:** This shark doubtless feeds mostly on large fish and sea turtles.

**SIZE:** Reaches a length of 36 feet, or more.

### BASKING SHARKS

Very large sharks with the lunate caudal fin and keeled peduncle of the mackerel sharks, but teeth very small, non-functional. Gill openings very long, occupying almost the entire side of the head.



17. **Basking Shark**  
*Cetorhinus maximus* (Gunner)

**DISTRIBUTION:** Casual, a male, 14 feet total length at Westhampton Beach Long Island, June 29, 1915. *Woods Hole*, August 16, 1906, and another in 1908. Some question as to identification. One June 24, 1920, Menemsha (mounted in Boston Society of Natural History Museum). *New York*, accidental.

Occurs in cold northern seas, circumpolar. Casual south of Virginia. In the early days it was common off Massachusetts, where it was presumably extirpated by the fishery for oil. The basking shark swims sluggishly in the open ocean, generally near the surface, at times in schools.

**FOOD:** It has feeding habits like those of the whalebone whales, its diet consisting of small animals which it sifts from sea water with the meshwork of its long, finely-toothed gill-rakers. "The alimentary canal of the Westhampton specimen contained a large quantity of bright red material which under the microscope resolved itself into a vast multitude of minute crustaceae." (Hussakof, *Copeia*, no. 21.)

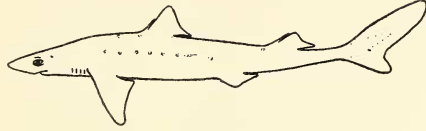
**SIZE:** Reaches a length of at least 45 feet.

## SPINED SHARKS

Small sharks with a spine in the front of each of the two back fins. No anal fin.

18. **Spined Dogfish**

*Squalus acanthias* Linnaeus



**DISTRIBUTION:** Usually abundant during the winter months, October to April. Moves in great schools and may vary greatly in numbers at given localities from year to year. One or two reports of its presence in summer. *Woods Hole*, May, again in October, and in general absent in the intervening months. *Orient*, October 5 to December 12; abundant in the fall, and taken in the spring as late as mid-May, occasionally to June 27. Young sometimes abundant in July. Occasionally adults in July and August, and at that season these are probably common on the deep water ledges in the Sound. *New York*, not uncommon, October to April, rarely occurs in summer (July 12, 1916); common spring and fall.

Occurs abundantly on both sides of the Atlantic, rarely south to Cuba.

Usually swims deep, at about the same depth as the cod, in schools or packs which are sometimes of immense size. With beam-trawl fishermen near the tilefish grounds at the edge of the continental shelf in late fall we have seen the trawl time after time fill up to overflowing with these dogfish. They were so abundant that it was impossible to catch anything else. Other fishes when brought up from this depth and pressure floated helplessly at the surface in a crippled and dying condition. Not so the tough, less specialized dogfish. These snapped viciously and struck at the hand with their spines, and when released swam away as good as ever, immediately beginning to spiral downward into the ocean depths from whence they came.

Though little marketed, the spined dogfish is an excellent food fish, if properly cooked. The flesh should be soaked or boiled in vinegar or some other acid, and cooked thoroughly with plenty of butter or oil. At one time it was rather extensively canned as "gray fish."

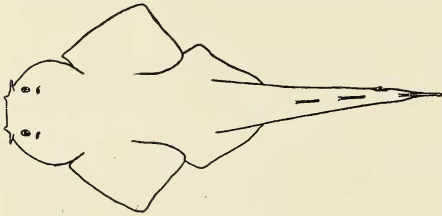
**FOOD:** Feeds on fishes (hake, herring), squid, worms; and apparently jelly-fish form an important item of its nutriment. At *Woods Hole*, *ctenophores*, a very abundant low group of jelly-fish, recorded as its most important food. A strong ammonia taint in its flesh which makes special cooking necessary may be correlated with this peculiar diet. At least a similar taint has been noticed in the flesh of the enormous whale shark, which occurs casually in Florida, tropical representative of the basking shark of the north. The whale shark may reasonably be supposed to sift quantities of jellyfish as food, among other things, from the warm seas where it has its home.

**LIFE HISTORY:** As in the requiem sharks, the eggs of the spined dogfish hatch within the body cavity of the mother, and the young are not released until well developed, nine inches to a foot in length. The species is peculiar, however, in that its young develop successively in twos and threes, several younger pairs being present before the oldest is released. At least this interpretation of the data is advanced by Couch, 1867, "British Fishes," who further states that for nine or ten months of the year the female produces young almost every day. Even if this be an exaggeration, the great abundance at times of this dogfish is easy to understand. On the other hand Bigelow and Welsh, 1925, "Fishes of the Gulf of Maine," consider that the spined dogfish gives birth to one or more regular litters annually of 1 to 11 young. Data furnished by F. A. Schneider on specimens brought to Fulton market by tile-fishermen in the winter of 1924 to '25 favors an hypothesis of a regular brood in early spring. Females between December and April contained from 3 to 7 well developed young, those in one fish in about the same stage of development; and generally about 4 or 5 large mature eggs. The yolk sacs were large in December, practically gone in February, young ready for extrusion in March. Between December and February fish brought in were about equally divided males and females. During March the males outnumbered the females 10 to 1.

**SIZE:** Reaches a total length of  $3\frac{1}{2}$  feet, and weight (exceptionally) of 15 pounds.

#### MONKFISHES

Shark-like fishes, more or less flattened dorso-ventrally, but with the gills on the side of the neck, not below. Head circular; neck constricted. Pectoral fins expanded, somewhat wing-like.



#### 19. Monkfish

*Squatina squatina* (Linnaeus)

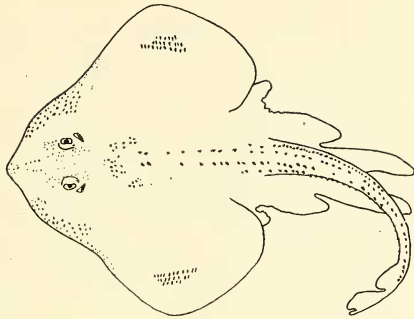
**DISTRIBUTION:** Rare in summer. *Woods Hole*, one of 35 or 40 pounds, 3 or 4 feet long, September 1, 1873; one 43 inches long, *Menemsha Bight*, September 23, 1921 (Francis West). *New York*, rare in summer.

Occurs in warm seas, uncommon on our coast from Cape Cod southward, common in the Mediterranean.

#### SKATES.

Shark-like fishes, flattened to lie on the bottom, face down. Pectoral fins fused with the body to form a rhomboidal disc, from which a slender spiny tail projects. Two dorsal fins placed close together far back on the tail.



**20. Common Skate***Raja erinacea* Mitchill

Snout end of disk broadly rounded, small teeth in about 50 rows.

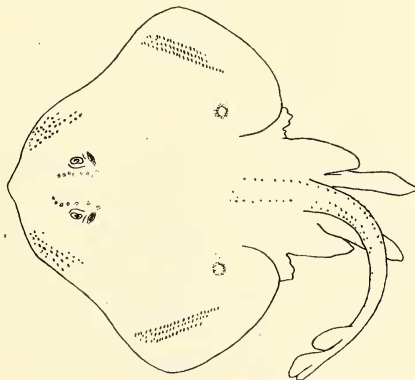
**DISTRIBUTION:** Common resident, frequenting especially sandy bottoms, ocean bays, and open sounds, apparently more numerous to the eastward in summer, to the westward in winter. *Woods Hole*, present from April to October. *Orient*, permanent resident. *New York*, common permanent resident. In Sandy Hook Bay noted October 10 to June 1, apparently absent during the summer.

Occurs from the Gulf of St. Lawrence to Virginia. Numerous in shallow as well as deep waters. At *Orient* it is taken more commonly during hot summer weather in shallow rather than deep water, and is washed ashore in winter gales. Found in Gardiner's Bay throughout the winter.

**FOOD:** Usually crustacea (crabs, shrimps, amphipods), also bivalve mollusks, squid, fish (*Ammodytes*, which hides in the sand, one species of fish mentioned).

**LIFE HISTORY:** Eggs are laid in summer, from May or earlier in the spring until October. The egg-cases of skates are familiar objects washed up along the sea shore. Leathery, rectangular, with lengthwise prongs at the four corners: usually blackish. The eggs of this skate are released during the summer months.

**SIZE:** Reaches a maximum length of 2 feet.

**21. Big Skate***Raja diaphanes* Mitchill

Resembles the common skate in shape, but is larger, teeth in about 90 rows. Usually an ocellated spot on each "wing."

**DISTRIBUTION:** Winter resident, September to June, common in water of 5 or 6 fathoms and deeper, migration probably inshore in winter, offshore in summer and an occasional individual present throughout summer months. *Woods Hole*, present from February till June and from October till the end of trap fishing; absent or very rare in summer. *Orient*, resident, rare in winter and warmer parts of summer. *New York*, rather common September to December 30, probably resident.

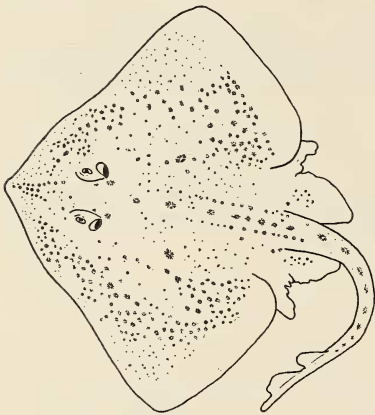
Occurs on the coasts of New York, Massachusetts, and northward to the Gulf of St. Lawrence, where it is common.

Skates are a first-rate food-fish, though not generally eaten by our native population, who do not like their looks. The thick bases of the pectoral fins at the side of the disk, or wings, is the part eaten.

**FOOD:** Mostly crabs, also squid and annelids, fish (herring, menhaden, billfish, etc.—*Orient*).

**LIFE HISTORY:** A female about a meter in length, taken May 11, contained ova ranging up to a walnut in size. Taken with egg case ready to release December 20 (*Cholera Bank*).

**SIZE:** Reaches a total length of 34 inches (a male, *Long Beach*) or more.



22. **Starry Skate**  
*Raja radiata* Donovan

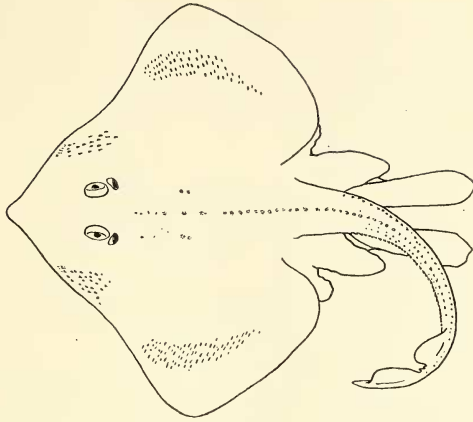
Snout ending in a short blunt angle. Body and tail armed with large bucklers, each with a stellate base. Teeth in 50 rows or less.

**DISTRIBUTION:** *Woods Hole*, *Menemsha Bight* fish traps, not common, none having been taken for years (*Edwards*).

Occurs on both coasts of the North Atlantic, rare on the American side; the American form (called *R. scabrata* by *Garman*) probably a distinguishable race.

**SIZE:** Reaches a length of 2½ feet.

23. **Clear-nosed Skate**  
*Raja eglanteria* Lacépède



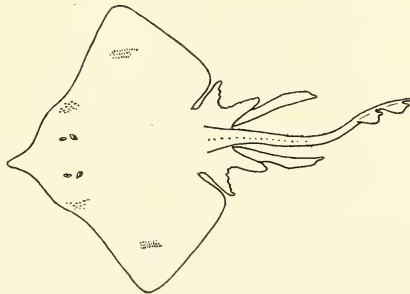
Snout ending in a pronounced, acute angle, with a translucent area on either side of it. Teeth in about 45 rows.

**DISTRIBUTION:** Rather common summer resident. April to November 1. Uncommon at the eastern end of the region. Common at Orient, mid-June through September. *Woods Hole*, formerly a few every year, one September 14, 1911. *Orient*, April 30 to November 1. *New York*, not uncommon, June 1 to October 21. Tends to absent itself from Sandy Hook Bay in the warmest weather, none recorded in September. A southern species which we have with us in summer, its migration being apparently along the coast.

Occurs from Cape Cod (casually Cape Ann) to Florida, not very common.

**SIZE:** Latham records one from Orient, 26 inches in length, weighing 11 pounds. A larger male  $25\frac{1}{4}$  inches long exclusive of the tail (snout to distal end intromittent organs) lying on ocean beach at Mastic, Long Island, May 18.

24. **Barn-door Skate**  
*Raja stabuliforis* Garman



Head and snout long, produced, ending in a blunt-tipped angle. Teeth in about 33 rows.

**DISTRIBUTION:** Rather common spring and fall, uncommon but regular to the eastward in summer, and occurs to the westward in winter. *Woods Hole*, common spring and fall, rare in summer. *Orient*, May 8 to December 14, regular but uncommon throughout the summer. *New York*, common, October to June.

Occurs from the Gulf of St. Lawrence to Florida. Usually taken in rather deep water.

**FOOD:** Bivalve mollusks, lobsters, crabs, and small crustacea, also squid and various fishes (cunners, and herring, menhaden, mackerel etc., recorded as food at *Orient*).

**LIFE HISTORY:** The egg-cases of this skate, which should be easily recognizable are not found east up on our beaches, as they are further south (North Carolina).

**SIZE:** Latham has measured one at *Orient* 52 inches long, 38 inches across, and states that specimens 100 pounds in weight have been taken near there. Reaches a maximum length of 6 feet or more.

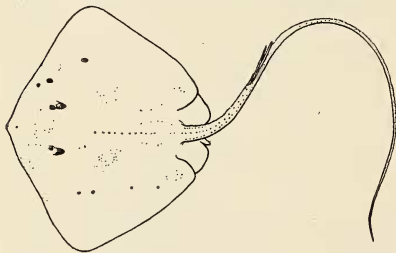
#### STING RAYS

Skate-like fishes, less strictly bottom-livers than the skates. The tail long, slender, finless, whip-like, with usually a single large dangerous saw-edged spine at its base. The flattened disk is roundish with a right angle at the snout and its greatest breadth forward. The spine and shape of the disk are subject to variation as some genera approach the Eagle Rays. The top of the head is always flush with the back; not squarish and elevated.

Tail long, whip-like, with a strong saw-edged spine at its base. *Dasyatis*

Tail whip-like but short, shorter than the disk, which is broader than long, its broadly pointed "wings" used like those of a bird. Caudal spine small or absent

*Pteroplatea*



25. **Sting Ray**  
*Dasyatis centrura* (Mitchill)

**DISTRIBUTION:** Not uncommon June 3 to October 3. *Woods Hole*, common in Buzzards Bay; rare at Menemsha, appearing in June or early July. *Orient*, formerly common, now very rare and irregular, June 3 to October 3. *New York*, uncommon, June 20 to September 23.

Occurs from Maine to Cape Hatteras. Abundant southward.

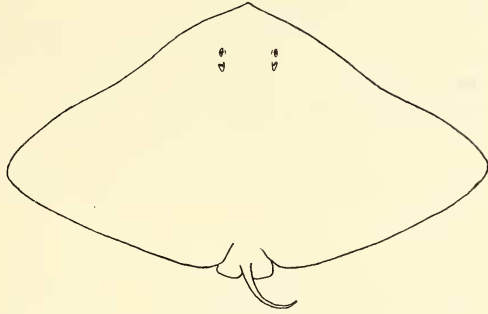
**FOOD:** Mollusks, crabs, annelids, etc., squid, and in one case, a small fish.

**LIFE HISTORY:** The sting rays bring forth their young alive.

**SIZE:** Reaches a length of 10 to 12 feet.

### 26. Butterfly Ray

*Pteroplatea maclura* (Le Sueur)



No spines at base of tail. No tentacle behind spiracle. Size moderate or small.

**DISTRIBUTION:** Uncommon in summer. *Woods Hole*, reported. *New York*, rare; one in Sandy Hook Bay, July 30, 1924, a female 30½ inches across, with ova small, about 5 mm. in diameter.

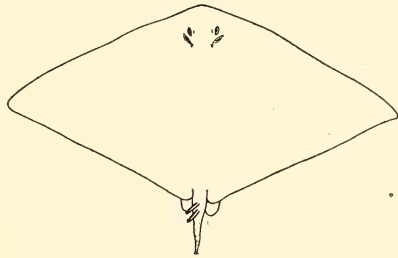
Occurs from Long Island to Brazil, not uncommon on the Carolina coast.

**FOOD:** Crabs.

**SIZE:** Reaches a width of perhaps 2½ feet.

### 27. Giant Butterfly Ray

*Pteroplatea altavela* (Linnaeus)



One or more spines at base of tail. A tentacle behind spiracle. Size large.

**DISTRIBUTION:** Accidental, one record. *Woods Hole*, July 3, 1922.

Occurs from the Mediterranean to Brazil and rarely off the capes of the Carolinas.

The butterfly ray has its name from its manner of swimming. It flits through the water with its great wings appearing much as butterflies do, flying through the air.

**SIZE:** The local record was a specimen 4 feet 2 inches across. Reaches 5 feet 10 inches width (*North Carolina*).



## EAGLE RAYS

Flattened rays which have secondarily reassumed the free-swimming habit, the sides of the disk, or wings, being pointed, and flapping in an almost bird-like manner. Head elevated and squarish; tail long and lash-like with one or more small serrate spines at its base.

Front of the head straight across.

*Myliobatis*

Front of the head emarginate.

*Rhinoptera*



## 28. Eagle Ray

*Myliobatis freminvillei* Le Sueur

**DISTRIBUTION:** Uncommon in summer and fall at the eastern end of the region. *Woods Hole*, not very common from July to October. *Sandy Hook Bay*, July 2, 1926, young  $14\frac{1}{2}$  inches wide.

Occurs from Cape Cod to Brazil.

**FOOD:** Feeds on lobsters, crabs, and large mollusks.

**SIZE:** Reaches a width of perhaps 4 feet.



## 29. Cow-nosed Ray

*Rhinoptera bonasus* (Mitchill)

**DISTRIBUTION:** Not uncommon in summer, especially to the eastward.

June 13 to October 15. *Woods Hole*, rather common, July 12 to October 15. *Orient*, formerly common June to September, unknown since 1906. *New York*, uncommon. June 13 to September 11; a few taken every year in Sandy Hook Bay.

Occurs rather commonly from Cape Cod to Florida.

**FOOD:** Feeds on clams, gastropods, small lobsters, crabs and other crustacea. The Cow-nosed Ray has hard paved teeth for eating mollusks and is said to be particularly destructive to the soft clam.

**LIFE HISTORY:** Ripe females, *Woods Hole*, July 12, 1889.

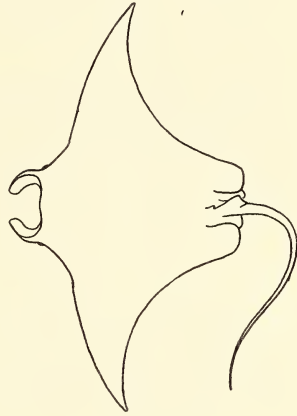
**SIZE:** Reaches a width of perhaps 6 feet.

### MANTAS

Rays similar to the eagle rays, but with a 'cephalic fin' on either side of the broad head which can be rolled into a forwardly directed 'horn,' whence the name 'devil-fish.' Teeth fine, insignificant. Whip-like tail shorter, comparatively, than in eagle rays.

#### 30. Great Manta

*Manta birostris* (Walbaum)



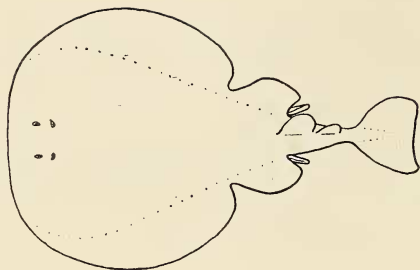
**DISTRIBUTION:** Accidental. A large individual about 14 feet across captured 10 miles off Block Island, about September 1, 1921.

Occurs in tropical waters on both coasts of America, straggling north to the Carolinas.

**SIZE:** Reaches a width of 22 feet and weight of over 3,000 pounds.

### ELECTRIC RAYS.

Bottom rays, suggesting the skates and certain of the sting rays in appearance. Disk rounded, tail stout, skin everywhere smooth, no spines. Possess electric organs, and can give a powerful electric shock.

31. **Torpedo***Tetronarce occidentalis* (Storer)

Distribution: Summer resident, May to November, regular to the eastward, very rare to the westward. *Woods Hole*, May till November, most common late in the fall at which time several may be taken together in one haul of the trap. *New York*, accidental, summer.

Occurs from Cape Cod, casually from Eastport, Me. to Cuba, uncommon; also in Europe.

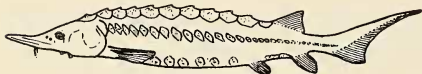
Bearing no armature of spines or prickles, the torpedo protects itself by its ability to give a severe electric shock. Before the days of kerosene the liver oil of this fish was valued for illuminating purposes.

Food: Fish.

SIZE: Average weight, 30 pounds. A specimen weighing 144 pounds from Nantucket, October 23, 1908. Another also from the Woods Hole region mounted by Francis West 1923, in the American Museum of Natural History, measures 4 feet 2 inches total length, 3 feet 2 inches across. Individuals as heavy as 200 pounds have been recorded.

## STURGEONS

Large fishes with more or less pointed snout; mouth on the under side of the head; and unsymmetrical, shark-like caudal fin, upper lobe the longer. Body armed with tubercles and rows of large, hard, bony plates. Enter fresh-water streams to spawn.

32. **Common Sturgeon***Acipenser sturio* Linnaeus

Snout nearly  $\frac{1}{2}$  length of head.

DISTRIBUTION: Rather uncommon. Reported at all seasons excepting January. Ascending rivers. *Woods Hole*, most numerous in June and July. *Orient*, has become rare. One of 8 feet, Greenport, May 26. Small specimens still taken in fall, September to December 8. *New York*, not uncommon, February to fall. In Sandy Hook Bay, small ones fairly common in mid-September, 1920.

Occurs on both sides of the North Atlantic, from the St. Lawrence to

Carolina and more rarely the Gulf of Mexico on our coast. Formerly abundant, but has been much reduced in numbers.

Adults enter the mouths of rivers in spring and slowly work their way up stream, usually at least beyond tide water before they deposit their eggs. A single female may produce between two and three million eggs. They eat little or nothing when running up river to spawn. The young are 4 to 5½ inches long at an age of 2 months. The old fish return to the sea after spawning, and the young may remain in the river for one or several years.

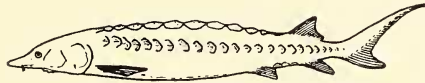
**FOOD:** The sturgeon is a bottom feeder, most abundant on sandy ground. It roots in the sand or mud with its snout, the barbels being used as organs of touch, and thus obtains worms and mollusks, doubtless also the sand lance, one of its favorite foods. It also sucks into its mouth various other fishes and crustacea.

**LIFE HISTORY:** The heavy adhesive eggs of the sturgeon are deposited in spring or summer. They average about 2.8 mm. in diameter. They hatch in about six days at a temperature of 65° F. The average number produced by a female is about 1,680,000.

**SIZE:** A length of 18 feet has been recorded for this fish from Europe and from New England. A recent local individual measured 8 feet total length (Orient).

### 33. Short-nosed Sturgeon

*Acipenser brevirostrum* Le Sueur



Snout about ¼ length of head.

**DISTRIBUTION:** Rather common at the western end of the region. *Orient*, irregular, usually rare, occasionally several in May, October and November. May 11 to December 2. *New York*, uncommon (May).

Occurs from Cape Cod to Florida; rare northward.

**SIZE:** Reaches 2½ feet total length (Orient).

## CATFISHES.

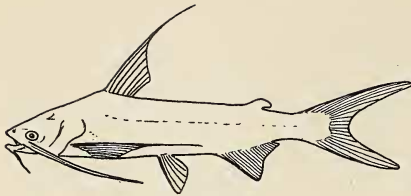
Small or medium sized scaleless fishes with a rayed dorsal fin before the middle of the back, and small adipose dorsal near the tail. Mouth transverse, surrounded by several barbels. Dorsal and pectoral fins each with a single stout spine.

Maxillary barbel long and bandlike, dorsal and pectoral spines with bandlike filaments, lower jaw with two barbels.

*Felichthys*

Barbels normal, spines without filaments, lower jaw with 4 barbels.

*Galeichthys*



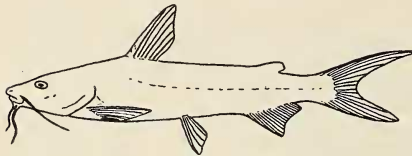
34. **Gaff-topsail Catfish**  
*Felichthys marinus* (Mitchill)

**DISTRIBUTION:** A straggler from the south. August and September. Occasionally common to the westward. *Orient*, twice recorded from Sound, June 4, 1906 and August 11, 1912. *Woods Hole*, 4 records (September 11). *New York*, occasionally common, August. *Sandy Hook Bay*, July 28, 1926.

Occurs from Cape Cod to Texas. Common southward.

**LIFE HISTORY:** The large eggs are carried in the mouth of the male until hatched and here the young find shelter until about 3 inches long and able to care for themselves. South of our territory this species breeds in June and July according to Gudger, from whose work the following data has been taken. The eggs are extremely large, averaging about 22 mm. in diameter. The male protects the eggs during incubation by carrying them in his mouth. A male of 22 inches may carry as many as 55 eggs in this manner. The fish hatch and nearly entirely absorb the yolk sac before they are liberated from their father's mouth. This period probably extends between 60 and 70 days.

**SIZE:** Reaches a length of about one foot.



35. **Sea Catfish**  
*Gleichithys milberti* (Cuvier and Valenciennes)

**DISTRIBUTION:** A rare straggler from the south. *Woods Hole*, very rare, none being recorded since 1887. Formerly recorded as at times common. *New York*, rare.

Occurs from Cape Cod to Texas; common southward.

The sea catfish is an abundant omnipresent fish in waters of the southern states, entering harbors otherwise almost barren of fish life. It is very active and hungry at night.

**SIZE:** Reaches a length of about one foot.

#### TARPONS.

Silvery, herring-like fishes with a single soft-rayed fin in the center of the back. Scales of moderate or large size. Lateral line present. Mouth large. Dentition various. Lower jaw the longer.



Body compressed, last ray of dorsal fin produced in a filament.

A large fish with large, heavy, silvery scales.

*Tarpon*

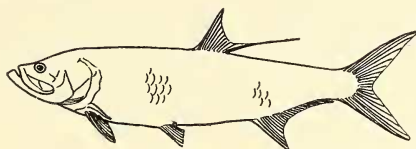
Body elongate more or less cylindrical. No dorsal filament.

Scales small.

*Elops*

**36. Tarpon**

*Tarpon atlanticus* (Cuvier and Valenciennes)



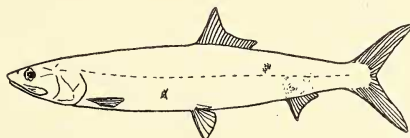
**DISTRIBUTION:** Rare summer visitor. August to October, most frequent to the eastward. *Woods Hole*, probably present every year, chiefly latter part of September, one August 31. Local specimens 80 to 100 pounds. *Orient*, casual, August 1, 1922, 4½ feet. Mid-October, 1924, Southold Bay, N. side Paradise Pt., 17½ pounds, Capt. E. C. Rouse of Greenport. *New York*, casual, summer and fall (October). Rare in Sandy Hook Bay. Occurs from Cape Cod (casually Nova Scotia) to Brazil, common coastwise from Florida south. The gigantic herring-like tarpon commonly enters the mouths of semi-tropical rivers and it is much sought by anglers for sport.

**LIFE HISTORY:** The eggs of Florida tarpon ripen in summer. They are exceedingly small and exceedingly numerous, estimated at 12 millions in a 142 pound female. Where they are deposited and whether there is a peculiar larval form is not known. Young tarpon, less than one foot in total length, are everywhere very rare.

**SIZE:** The record seems to be 8 feet 2 inches total length; estimated weight 350 pounds.

**37. Big-eyed Herring**

*Elops saurus* Linnaeus



**DISTRIBUTION:** Uncommon fall visitor, October 6 to November 4, most frequent to the eastward. *Woods Hole*, uncommon in fall, none recorded before October. *Orient*, uncommon, October 6 to November 4. *New York*, rare, October. (October 12.)

Occurs in warm seas. Cosmopolitan. Ordinarily rare, this species was comparatively common near Sandy Hook in the fall of 1923.

The following data was taken from a sample of 13 taken on October 19 from a single pound net:

*Standard Length*  
 Maximum 43 cm.  
 Average 35 "  
 Minimum 33 "

*Weight*  
 1 5/8 pounds  
 1 3/4 "  
 3/4 "  
 4 "

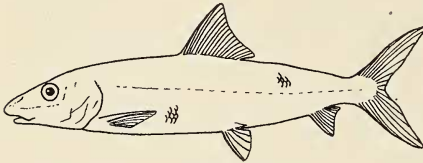
The stomachs of all were empty save one which contained a piece of *Ulva*, no doubt taken accidentally.

Examination of the scales, although they were difficult to read, suggested that these fish were just entering on the second winter of their existence, through which they bore scales large enough to read the season's marks on, that is, they were probably hatched during the spring or summer of 1921. Proportional measurements indicated that they averaged about 22 mm. last winter.

SIZE: Local specimens range from 8 to 15 inches.

#### BONE-FISHES.

Silvery, herring-like fishes with a single soft-rayed fin in the middle of the back. Mouth small, under the pig-like snout. Scales rather small. Body sub-cylindrical.



38. Bonefish  
*Albula vulpes* (Linnaeus)

DISTRIBUTION: Casual (October). *Woods Hole*, recorded. *New York*, accidental, October.

Occurs in warm seas, cosmopolitan, north casually to our region.

The bonefish, on account of its game qualities, ranks very high with sportsmen. It is also an interesting species from a scientific or philosophical point of view. Though nowhere occurring in the abundance or in the close schools that are characteristic of various species of herrings, it has an enormous range and is not uncommon in the warmer seas of the entire world. It is more or less related to the herring family, having doubtless been evolved from ancestors of the herrings ages ago and proved so successful in life's competition that we have it with us to-day, practically unchanged, though all its close relatives have passed into history.

Bonefish probably feed to a considerable extent on small shelly animals which they suck out of the mud, for they have hard, stony pavement-like teeth in the back of the mouth. Such teeth have often been found as fossils and we know that there were bonefish in earlier seas as far back as the Eocene. Whether, as to-day, the early bonefish belonged to a single species, or whether the tribe was then more numerous and varied, is a matter for conjecture.

Most fishes which subsist on so lowly a diet are sluggish, and protected against their enemies by hard shells, strong spines or a concealing resemblance to the mud, or weeds where they hide. Not so the bonefish. Big-eyed, alert, its long cylindrical body is endowed with phenomenal speed and strength. Many of the true herrings swim in vast compact schools,

growing fat from the rich harvest of small food they are able to sift from the water with their large mouths and network of fine gill-rakers. They are destroyed in enormous quantities by various predacious creatures and hold their own by their very ability to multiply in proportion; but the bonefish is comparatively solitary and self-sufficient.

**LIFE HISTORY:** Passes through a flattened, transparent larval form as does the common eel. Such larval forms probably do not parallel the development of the race, but are a special adaption to early life, like the caterpillar of the butterfly.

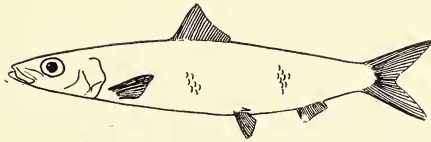
**SIZE:** Reaches a total length of 31 inches and weight of 13 pounds.

### HERRINGS.

More or less compressed, silvery fishes of moderate or small size. Scales variable in size, frequently large, no lateral line. Caudal fin well forked. Mouth large, the jaws about equal or the lower somewhat the longer. Teeth very small or absent. Gill-rakers very long and fine. A single soft-rayed fin in the middle of the back. Frequently knife-like, keeled scutes along the ventral outline.

- |   |   |
|---|---|
| a. Belly rounded, covered with ordinary scales.<br>Belly compressed, armed with serrae which are more or less bony and sharp (see b). | <i>Etrumeus</i>                         |
| b. Last ray of dorsal produced in a filament<br>Scales with their posterior margins vertical and pectinate.<br>Not as above (see c).  | <i>Opisthonema</i><br><i>Brevoortia</i> |
| c. Ventral scutes weak, scales about 57<br>Ventral scutes weak, scales about 45.<br>Ventral scutes strong and sharp (see d).          | <i>Clupea</i><br><i>Sardinella</i>      |
| d. Cheeks longer than deep, scales 50 to 52.<br>Cheeks deeper than long, scales about 60.   | <i>Pomolobus</i><br><i>Alosa</i>        |

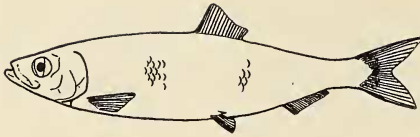
#### 39. Round Herring *Etrumeus teres* (De Kay)



**DISTRIBUTION:** Uncommon in summer and fall, at times occurring in large numbers, May 24 to December 8. *Woods Hole*, ordinarily rare, occasionally abundant, July 3 to October 21. *Orient*, more or less common every summer, May to October, sometimes abundant, May 24 to December 8. *New York*, uncommon, July to October.

Occurs from Cape Cod (casually Maine) to the Gulf of Mexico, mostly on sandy shores, not rare southward.

**SIZE:** Average 5 or 6 inches, largest 7 inches total length. (*Orient*.) A very large one, 15 inches (*Sandy Hook Bay*).



40. **Sea Herring**  
*Clupea harengus* Linnaeus

**DISTRIBUTION:** Present at all seasons in irregular numbers, few or none from mid-July to fall. Adults abundant to the eastward in fall and fry taken there throughout winter. *Woods Hole*, adults with spawn appear about October 15, remaining until cold weather, fry taken by towner from October to June. *Orient*, May 15. A few adults (12 inches) July 16. *New York*, irregular, all seasons, Uncommon in Sandy Hook Bay, medium sized individuals to July 7, and again on October 17.

Occurs northerly in the North Atlantic on both coasts, occasionally south to Cape Hatteras in winter.

**FOOD:** The herring is probably the most numerous fish in the colder waters of the North Atlantic. It swims in great schools, feeding on plankton. Having reached the length of about  $\frac{1}{2}$  inch, it depends almost exclusively on copepod crustacea for food. As it grows older it feeds more and more on larger shrimps, etc. Bigelow and Welsh say:

“When feeding on copepods herring swim open-mouthed, often with their snouts at the surface, crossing and recrossing in their tracks and evidently straining out the minute crustaceans by means of their branchial sieves, a straining apparatus of coarser mesh than that of the menhaden and consequently capturing larger plankton and letting the microscopic plants pass through.

“When feeding on euphausiids, as we ourselves have often seen them engaged and with which the large fish are often gorged, they pursue the individual shrimps, which often leap clear of the water in their efforts to escape.”

Herring are an important food of other larger fishes. The silver hake in particular at times drives schools ashore, sometimes stranding on the beaches with its intended victims. The finback whale devours them in quantity, and squids destroy the young.

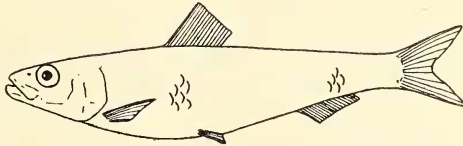
**LIFE HISTORY:** In our territory the spawning season of the herring is at its height in November. The eggs are demersal and adhesive, adhering to any nearby submerged object; usually stones or sea weed. The average number deposited by a female is about 30,000. The average diameter of the ova is about  $1\frac{1}{4}$  mm. They hatch in about 22 days at a temperature of 45° Fahr. The larval fish have a length of about 6 mm. on hatching and remain close to the bottom until the yolk sac is exhausted. The growth of the herring appears to be highly variable from one locality to another, dependent on a large number of factors. They appear, however, to reach maturity in about the third year. At times a length of 18 inches is reached,

although such a size is unusual and the average spawning fish is most frequently about 12 inches in length.

SIZE: 14 inches total length, weight 12 ounces; 13 inches total length, weight 14 ounces; very large individuals (Orient). The maximum is about 18 inches.

#### 41. Spanish Sardine

*Sardinella anchovia* Cuvier and Valenciennes



A conspicuously striate area on either side of the nape; the two adjacent behind and diverging forward.

DISTRIBUTION: *Woods Hole*, generally rare, sometimes numerous, appears during September, October and November. We have to hand a specimen  $3\frac{1}{4}$  inches total length, Montauk, September 17, 1923, Murphy and Harper, but know of no definite record further west.

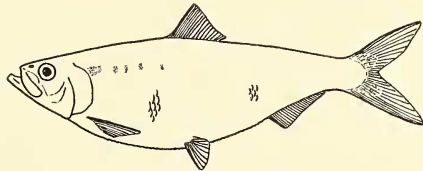
Occurs from Cape Cod to Rio de Janeiro, and is represented in Europe by the allied *S. aurita*, questionably distinct.

FOOD: Feeds on copepods (*Woods Hole*, August).

SIZE: Commonly reaches about 6 inches.

#### 42. Hickory Shad

*Pomolobus mediocris* (Mitchill)



Peritoneum pale. Head long, about 4 times in length to base of caudal.

DISTRIBUTION: Rather common April 1 to December 20, most numerous in the fall, has not been recorded to the westward before July. *Woods Hole*, present from spring till end of trap-fishing season, most numerous in the fall. April 1 to December 20. Common spring and fall, adults rare and irregular in summer, young sometimes abundant in July and August. New York, July 8 through November.

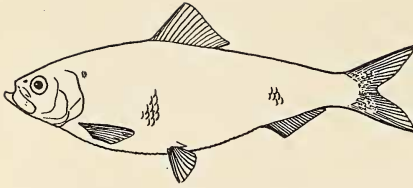
Occurs from Cape Cod (casually Maine) to Florida, not ascending stream to spawn.

During August examples were taken in Sandy Hook Bay which averaged about 250 mm. in standard length.

FOOD: Feeds on fish (launce, anchovies, herring, silversides, porgy, cunner, etc.) squid, small crabs, and other crustacea.

SIZE: Reaches 2 feet in length and a weight of  $2\frac{1}{2}$  pounds.





## 43. Alewife

*Pomolobus pseudoharengus* (Wilson)

Peritoneum pale. Head short and heavy, about  $4\frac{2}{3}$  times in length to base of caudal.

**DISTRIBUTION:** Abundant, present at all seasons, rare in January. Adults arrive from February to April, ascending fresh-water streams to spawn, and return to the sea in May, where they are sometimes abundant in fall. *Woods Hole*, arrives in March and April, passing then into fresh-water and returning in May. Abundant also in October and November. *Orient*, throughout the year; irregular and uncommon in winter after December 20; abundant March to May, and in fall. *New York*, common, February to December 18.

Occurs from Nova Scotia and the Gulf of St. Lawrence to the Carolinas, entering fresh water streams to spawn in their tributary ponds or quiet stretches.

**FOOD:** The alewife is chiefly a plankton feeder, subsisting on minute crustacea. It also eats larger shrimps and various small fishes, and on the other hand often contains food as small as diatoms, even when adult.

This fish is excellent eating, and a favorite bait for cod, etc.

River herrings of the genus *Pomolobus*, the shad, and the sea herring, which also moves in shore to spawn, move off shore to avoid unfavorably low winter sea temperatures. There is no evidence that they undertake any extensive north-south migrations along the coast.

**LIFE HISTORY:** Spawns in streams and ponds in April and May, returning to the sea when spent. By fall the young have all found their way down to salt water, where they live until sexually mature, usually in schools as does the herring.

The examination of a series of fishes of this species from their spawning grounds in the Swimming River, a confluent of Sandy Hook Bay, revealed that the ripe males averaged 240 mm. in standard length while the females averaged 15 mm. more. The sexes were present in about equal numbers in both 1922 and 1923. During the latter year the first specimen was seen on March 26 and the last one on May 13. On May 2, 6 per cent. of the fish were spent. As in other places the runs of this species precede that of the shad, a few only now being taken in this stream.

The eggs average over 100,000 for each female. They are adhesive and demersal, adhering to anything with which they come in contact, somewhat after the manner of those of *Clupea*, whose eggs they about equal in diameter. At a temperature of 60° F. they hatch in about six days into active larvæ. According to Smith, in North Carolina they reach a length

of 3 or 4 inches by fall. This is in fair agreement with the results of the examination of scales from a small series of fish from this River, although our data indicates a slightly faster growth, as follows:

<i>Standard Lengths.</i>				
<i>1st winter</i>	<i>2nd winter</i>	<i>3rd winter</i>	<i>4th winter</i>	<i>5th winter</i>
116 mm.	196 mm.	233 mm.	249 mm.	254 mm.

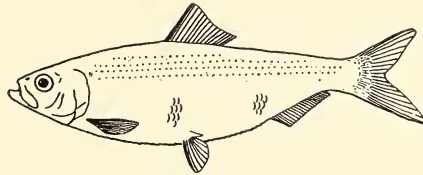
Fish approaching their second and third winter are most common in Sandy Hook Bay in summer. Small examples of about 60 mm. standard length, approaching their first winter, are sometimes fairly common in July.

The bulk of the spawners were four years old according to our calculations. No previous spawning rings could be discerned and it seems likely that this was the first spawning for these fishes. At this size they average a little less than one-half pound. In July fishes of this species taken in Sandy Hook Bay averaged about 70 mm. in standard length, which in comparison with the above table would make them of the last spawning. One from a little further east, Mastic, L. I., July 29, 1923, was 67 mm. standard and 83 mm. total length. As one proceeds eastward the warming of the sea water in spring is delayed, and one would expect the season to be a little later.

SIZE: Reaches  $14\frac{3}{4}$  inches total length (Orient).

#### 44. Glut Herring

*Pomolobus aestivalis* (Mitchill)



Peritoneum black, otherwise much like *pseudoharengus*.

DISTRIBUTION: Rather common June 1 to December 9. The evidence indicates that its abundance shifts from west to east during the warmer months. *Woods Hole*, common, comes later than the alewife, taken in September and October. *Orient*, usually rare, June 20 to December 4, sometimes abundant from July 20 to mid-August. *New York*, not uncommon, June 1 to August, young to December 9.

Occurs on the Atlantic Coast from Nova Scotia to Florida, more abundant than the alewife in the Southern States and less abundant northward.

This species closely parallels the alewife in habits as in appearance. No commercial distinction is made between the two.

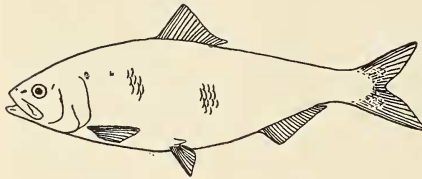
LIFE HISTORY: Spawns in brackish ponds (*Woods Hole*); does not run far above tide-water.

DEVELOPMENT: This anadromous clupeoid spawns in fresh or nearly fresh water. The spawning season is a long one but appears to be at its height in July. The eggs are demersal, slightly adhesive, yellowish in color and have an average diameter of 1.0 mm. The eggs hatch in about 50 hours at a

temperature of 72° F. When newly hatched the larvae measure about 3.5 mm. At a length of about 40 mm. most of the diagnostic characters of the adult are present.

A young one picked up cast on the ocean beach (at Long Beach, L. I.) December 9, 1920, was 45 mm. in standard length, of course in its first year; and one on November 5, 1922, was 102 mm., presumably in its second. Others averaging 83 mm. in standard length taken in Sandy Hook Bay on June 2, 1925, and specimens averaging 96 mm. from Jamaica Bay, October 21, 1925, would seem to have been in the same year class, spawned the preceding summer (1924).

**SIZE:** Reaches one foot or somewhat over in length.



#### 45. Shad

*Alosa sapidissima* (Wilson)

**DISTRIBUTION:** Not uncommon, though far less numerous than formerly. Present from March 16 to December 20. Runs towards fresh-water streams to spawn about May 1, and is rarely met with coastwise after October. *Woods Hole*, comes about May 1, remaining only about a week, contains well advanced spawn on arrival. *Orient*, irregularly common April 16 to June 1; adults rare in summer and fall; young more frequent in fall, to December 20. Average spring arrival (16 years) April 20. *New York*, not uncommon (March 16) May to October (December).

Occurs from the Gulf of St. Lawrence to Florida; and has been successfully introduced on the Pacific coast.

Shad are taken commercially, commonly in nets, but there are numerous instances of their taking the hook.

**FOOD:** They are primarily a plankton feeder, subsisting on small or minute crustacea; copepods being a large item in their food.

**LIFE HISTORY:** Shad enter rivers in spring to spawn, when the river water has warmed to 50° or 55°. Consequently the run begins at correspondingly later dates along the coast, January in Georgia, April in the Potomac, May and June at the northern end of their range. Sandy or pebbly shallows are selected as a spawning ground. The adults return to the sea in summer, the young in the fall at a length of 8 inches or less.

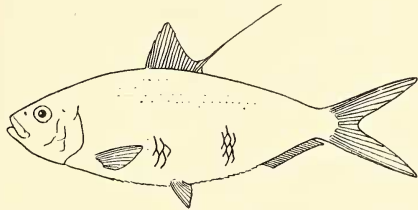
The few shad yet to be found in our polluted rivers appear after the run of alewife has passed its peak. The males arrive first, followed in a short time by the heavier females. These average about 28,000 eggs apiece, but there are records as high as 156,000. The ova have a specific gravity slightly greater than one, are non-adhesive and average about 3 mm. in diameter. The time of incubation is about one week at a temperature of

60° Fahr. They hatch into larvae not quite 10 mm. in length. By the time winter sets in a length of from 3 to 9 inches is attained, depending upon conditions in which they are living. They reach maturity in about the third or fourth year, and when ripe the males average about 3 pounds and the females about  $4\frac{3}{4}$  pounds. The record for the Atlantic coast is  $13\frac{1}{2}$  pounds.

SIZE: Adult fish average about 4 pounds in weight. Males sometimes reach a weight of 6 pounds and females 8 pounds. The maximum size for the species is  $2\frac{1}{2}$  feet in length, and 12 to 14 pounds in weight.

#### 46. Thread Herring

*Opisthonema oglinum* (Le Sueur)



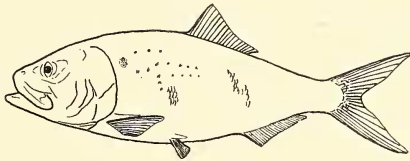
DISTRIBUTION: Uncommon and irregular, July 7 to October 21, very exceptionally present in numbers then mostly to the west. *Woods Hole*, very rare, July till fall. *Orient*, rare, July. *New York*, usually uncommon, July 7 to October 21, sometimes present in numbers. Always present in summer in Sandy Hook Bay.

Occurs abundantly in the West Indian fauna, regularly north to Carolina and sometimes strays to Cape Cod.

SIZE: Reaches  $8\frac{1}{2}$  inches in total length (*Orient*).

#### 47. Menhaden

*Brevoortia tyrannus* (Latrobe)



DISTRIBUTION: Very abundant everywhere—(March) April 12 to November 28 (adult) and December 15 (young). *Woods Hole*, (March) May 20 to December 1. Most abundant in June. *Orient*, April 12 (average April 26) to November 28 (adult) and December 15 (young). Young sometimes occur in great waves in fall, peaks of these waves occurring in October and November. In 1917 a similar wave of lesser magnitude occurred between July 20 and August 15; that year the first young having appeared on July 1. The same year the size of the young was about constant from July 20 to October 20, indicating migration to the west from some area of later spawning. *New York*, abundant, May to November (December 5). In 1921 Menhaden diminished in numbers in Sandy Hook Bay as the weakfish increased after September 15.



Occurs from Nova Scotia to Brazil. Menhaden occur off our shores in immense compact schools throughout the summer. They swim at the surface, often with their back fins out of the water, are much preyed upon by other fishes, as well as being caught in bulk for oil. The menhaden often runs into brackish water. A serious epidemic occurred among menhaden to the eastward in 1904, and enormous numbers of dead drifted to shore in Narragansett Bay and considerable numbers in New Bedford Harbor.

**FOOD:** As they swim, their wide mouths are kept almost constantly open, gulping salt water, which is strained out through the exceedingly fine, long gill-rakers, the fish thus securing a rich food-supply of microscopic plants, particularly diatoms, and the smallest crustacea, getting very fat.

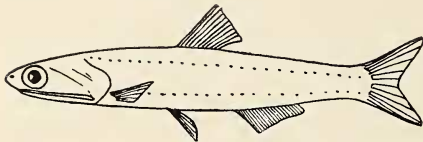
**LIFE HISTORY:** Schools of young 19 to 25 mm. in length are common during July at Woods Hole. At Orient a total length of 51 to 76 mm. is recorded July 1; 102 mm. July 20 to August 15; 76 to 127 mm. October 26; averaging 127 mm. and a few of the largest 208 mm., November 21.

The spawning of the menhaden covers practically the entire year. That is, at some point along the Atlantic coast these fish may be found spawning during nearly any month. In our latitude, however, the act seems to be confined to the warmer months, and is probably going forward in June, a little earlier to the west, later to the east. The eggs are highly transparent, spherical, and range from 1.4 to 1.6 mm. in diameter. The perivitelline space is usually large and a single oil globule is present. Incubation occupies about 48 hours at a temperature of 72° F., and on hatching the slender larvae average 4.5 mm. At 23 mm. all the fins are differentiated and the intestine is highly convoluted. At 40 mm. they resemble the adults in all important essentials. Maturity seems to be reached in about the third year.

**SIZE:** One taken in 1876 measured 18 inches, probably the largest on record. A weight of 1 pound 13 ounces is recorded from Orient. In Sandy Hook Bay most of the fish taken in the pound nets are less than a foot in standard length. There is generally a mode at about 9½ inches, and another at 5 inches in the late fall.

## ANCHOVIES

Small, herring-like fishes, swimming in large schools at or near the surface. Mouth, very large, opening beneath a more or less produced pig-like snout. A single soft-rayed fin in the middle of the back. A silvery band along the center of the side.



48. Flat Anchovy  
*Anchovia perfasciata* (Poey)

Anal rays 14 to 16. Slender, depth about 6 times in the length to base of caudal.



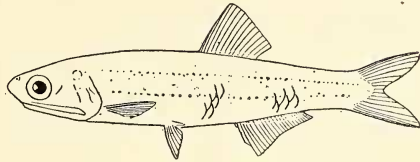
**DISTRIBUTION:** Recorded from the vicinity of New York City in September.

Occurs rather commonly from the Florida Keys to Cuba.

**SIZE:** Reaches a length of perhaps 5 inches.

#### 49. **Striped Anchovy**

*Anchovia brownii* (Gmelin)



Anal rays about 20. Body compressed, moderately slender, depth about  $4\frac{3}{4}$  in the length to base of caudal. Eye larger,  $3\frac{1}{2}$  in the head. The silvery band sharp and bold.

**DISTRIBUTION:** Rather uncommon in summer and fall, more numerous to the eastward, May 1 to November 14. *Woods Hole*, usually abundant, present from first of May till late in fall. *Orient*, rather uncommon, June 25 to November 14. *New York*, uncommon, summer (June 27, 1921, and July, 1923, Sandy Hook Bay).

Occurs from Cape Cod to Brazil, abundant on the Florida coast and in the West Indies.

Schools of this anchovy, with those of the hardhead, *Atherina stipes* (Muller and Troschel) are usually to be found about wharves in Florida, as are schools of *Menidia* in the north.

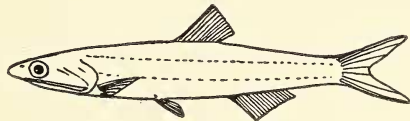
**FOOD:** Usually copepods, also univalve mollusks.

**LIFE HISTORY:** With ripe spawn till August (*Woods Hole*).

**SIZE:** Up to  $6\frac{1}{4}$  inches total length (*Orient*). Specimens slightly over 4 inches in standard length were taken in Sandy Hook Bay, July, 1923, where they usually measure about  $2\frac{3}{8}$  inches.

#### 50. **Silvery Anchovy**

*Anchovia argyrophana* (Cuvier and Valenciennes)



Anal rays about 19. Body little compressed, slender, depth about 6. Eye small, 4 in head.

**DISTRIBUTION:** Not uncommon at times to the eastward, rare to the westward. June to November 23. *Woods Hole*, irregular, sometimes absent, sometimes numerous, most numerous in fall, to November 20. *Orient*, one taken November 23, 1917. *New York*, casual, June to August 20, also November 18.

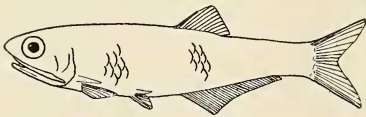
Occurs in the Gulf Stream, occasional northward.

The eastern end of our region, though actually somewhat further north

and with generally colder water, lies closer to the Gulf Stream drift than does the western end, New York being situated in a broad bight in the coastline. Hence various fishes which, either as adults or young, occur in the Gulf Stream, tend to be more frequent there. This anchovy is an example.

**LIFE HISTORY:** This anchovy spawns, like the following, chiefly in July and August. The eggs are similar to those of *A. mitchilli* but are larger, the long diameter ranging from 1.15 to 1.25 mm. whilst the short one ranges from 0.55 to 0.80 mm. The newly hatched larvae are about 3 mm. long. The yolk is absorbed in about a day. By the time 5.2 mm. is reached the vertical fins begin to show differentiation and the intestine becomes greatly convoluted as in most young clupeoids.

**SIZE:** Up to 6¼ inches total length (Orient).



51. **Common Anchovy**  
*Anchovia mitchilli* (Cuvier and  
Valenciennes)

Anal rays 25 or 26. Snout blunt and body deep, depth about 4. Silvery band diffuse.

**DISTRIBUTION:** Abundant to the east and less numerous to the westward, most numerous in fall, May 1 to December 14. *Woods Hole*, abundant, May 1 till fall. *Orient*, common, June 11 to December 14. *New York*, common, May to October 30.

Occurs from Cape Cod (rarely Maine) to Texas on sandy shores, entering rivers, abundant.

**LIFE HISTORY:** The spawning of this delicate species takes place in mid-summer, and it is believed that the spawning act is performed usually at dusk. The eggs are pelagic, transparent and contain no oil globule. The yolk has the appearance of being fragmented into numerous pieces. The egg is elliptical. The greatest diameter ranges from 0.65 to 0.75 mm., while the lesser ranges from 0.45 to 0.55 mm. At about fourteen hours after fertilization the eggs sink in sea-water and the development is typical. The incubation period is about 24 hours at the end of which time larvae 1.9 mm. in length emerge. They are transparent and show no pigmentation. In twelve hours they attain a length of about 2.7 mm. At about sixteen hours after hatching, the yolk is completely absorbed. The critical period for this species is at the close of the second day after hatching. At a length of 7 or 8 mm. the fins begin to become rayed and from then on the development slowly changes the post larva into the adult. The age at spawning is unknown. In Sandy Hook Bay one group appeared to grow from 65 mm. average standard length in the latter part of May, to 70 mm. in the middle of July. Near the end of July a smaller group of about 45 mm. appeared, very likely fish one year old.

**SIZE:** Reaches 4 inches in total length.

## TROUT

Trimly built, active fishes with large mouths and strong teeth. Usually silvery (when in the sea). Single soft-rayed fin in the center of the back, a small adipose fin nearer the tail. Scales fine, scarcely evident.

Spots on sides black.

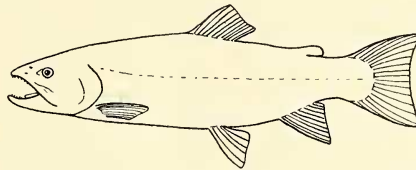
*Salmo*

Spots on sides red or blue, not black.

*Salvelinus*

**52. Rainbow Trout**

*Salmo irideus* Gibbons



Rainbow trout. Black spots not x shaped; scales 135-140; teeth in the center of the roof of the mouth persistent.

**DISTRIBUTION:** The rainbow trout occasionally runs to sea from local coastwise streams where it has been planted. A recent definite instance is the capture of a female specimen, 12 $\frac{3}{4}$  inches standard length, Sandy Hook Bay, June 9, 1925, and July 1, 1926.

Occurs in California, and widely planted elsewhere in the United States.

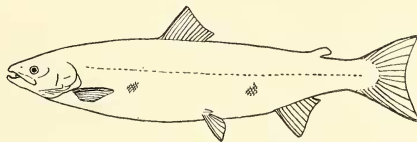
**LIFE HISTORY:** The rainbow trout spawns from November to March in the eastern part of the United States. The eggs are heavy and non adhesive as with others of this family. They average about 0.5 mm. in diameter. They hatch in from 42 to 45 days at a temperature of 50° and the yolk sac is absorbed in about 30 days.

The males attain maturity in 2 years but few females before the third.

**SIZE:** Reaches a weight of upwards of 10 pounds.

**53. Atlantic Salmon**

*Salmo salar* Linnaeus



Black spots usually x or xx shaped; scales about 120 in a lengthwise series; teeth in the center of the roof of the mouth few and deciduous.

**DISTRIBUTION:** Formerly numerous, entering rivers. Now very rare to the west, a few occur to the east. *Woods Hole*, a few (chiefly small specimens) taken every year, generally in May, also one of 25 pounds, June 28, 1899. *Orient*, one definite record, May 13, 1909. *New York*, now casual.

Occurs in the North Atlantic, ascending favorable rivers on the European and American side, north of Cape Cod, to Hudson Bay, formerly probably abundant in the Hudson and occasional in the Delaware.

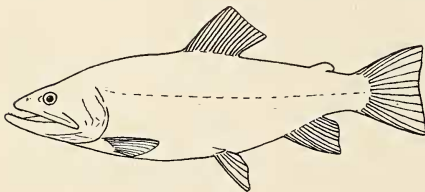
Salmon are believed to move off shore in the winter and in shore in the

summer, whether or not ready to enter fresh water and spawn. They feed very little when in fresh water at least when about to spawn, and as most of their growth occurs in summer normally, it is interfered with by spawning. Each fish spawns from one to several times, some more often than others, and those which do so every year after adolescence do not reach so large a size.

**FOOD:** The salmon in the sea is an active predaceous fish, preying on other smaller fishes and to some extent crustacea. Sand lance, herring and capelin are among its favorite fish foods.

**LIFE HISTORY:** The Atlantic Salmon spawns near the head waters of rivers in October and November. The cold waters of such localities makes the incubating process a long one, hatching not occurring before April or May. The eggs are heavy, non-adhesive, and average about 7 mm. in diameter. They are deposited amid coarse gravel, lodging in the interstices, which fact doubtless aids in keeping them from being washed down to sea. The average number a female deposits is over 9,000. The maximum is nearly 21,000. The larval salmon is slightly less than an inch in length on hatching, and possesses a large yolk sac which is absorbed in about 40 days. After passing from the larval stage it acquires a series of vertical bars on the sides. This coloration is retained for about two years. at the end of which time it may be from 6 to 8 inches long. At this size and age it passes down stream to the sea and takes on the appearance of the adult. When next heard from it has attained a weight of from 2 to 6 pounds and in the northern extent of its range passes up-stream with adults. In our territory, however, this migration is usually omitted, but by the time it is about 4 years old it returns to the spawning beds for the consummation of that act and, unlike the Pacific salmons, may return to the sea to repeat its spawning migration the following year.

**SIZE:** 88 pounds (Great Britain) appears to be the largest on record.



#### 54. Brook Trout

*Salvelinus fontinalis* (Mitchill)

**DISTRIBUTION:** Not uncommon in fresh-water streams, entering the sea to the eastward. *Woods Hole*, some enter salt water and pass the winter there.

Occurs (native) in clear cold streams from Maine to the Saskatchewan and northward to Labrador, south in the mountains to the southern states, enters the sea freely from New England northward.

Trout lie in pools or eddies or behind snags whence they dart away with lightning-like rapidity when alarmed, or spring upon their prey when it

drifts within range. The eastern brook trout is one of the wariest and gamest of fish and to land it taxes the sportsman's best skill. It seldom exceeds 2 or 3 pounds in weight and a 5 pound fish is a very large one, though there are records of still larger.

**FOOD:** They feed largely on insects which drop by chance upon the surface of the water.

**LIFE HISTORY:** Brook trout spawn in September and October in clear rapid streams over a gravelly bottom. The eggs are heavy, non-adhesive, and average about 1.6 mm. in diameter. The maximum number produced by a large female is over 9,000,000. At a temperature of 50° Fahr. hatching is reached in about 50 days and the yolk sac is gone in 25 days more. At 37°, hatching is prolonged to 125 days and the absorption of the yolk sac takes about 40 days. Maturity is usually reached in the second year. The growth of this species under good conditions is generally about as follows:

<i>Age</i>	<i>Weight</i>
1 year	1 ounce
2 years	9 ounces
3 years	1 pound

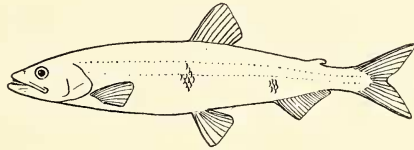
**SIZE:** An individual 14½ pounds (from Ontario) appears to be the largest on record.

### SMELTS.

Small, silvery, trout-like fishes. Silver color more or less concentrated in a lateral band. Scales (in our species) larger than in the trout, about 68 in a lengthwise series. A single soft-rayed fin in the middle of the back and small adipose fin behind it.

#### 55. Smelt

*Osmerus mordax* (Mitchill)



**DISTRIBUTION:** Rather common, present throughout the year. Most numerous in the colder months. *Woods Hole*, resident, most abundant in March. *Orient*, resident, October 2 to June 9, common November to April, also summer records for July 14 and August 28. *New York*, common, resident. *Sandy Hook Bay*, May 11, 1926.

Occurs from Virginia, rarely, New Jersey regularly, to the Gulf of St. Lawrence, entering streams from the sea.

In our region only the young or an occasional larger individual can be found in the bays during the warmer months.

They are very abundant, being taken in large numbers by nets and by hook and line and are one of the choicest of our food-fishes.



**FOOD:** The smelt is active and predaceous, feeding greedily on swimming crustaceans and smaller fishes.

**LIFE HISTORY:** Spawns in February and March (Woods Hole). The smelt enters fresh or brackish waters, usually rivers or brooks for the purpose of spawning in early winter. As soon as the spawning is completed, they return to the sea, and when summer approaches they move off shore (not far) to find cool waters. The eggs are demersal and adhesive and average about .05 inches in diameter. A 2 ounce fish may deposit up to about 50,000 eggs.

**SIZE:** Adults are 7 to 9 inches in length, maximum 13 or 14 inches.

### LIZARD FISHES

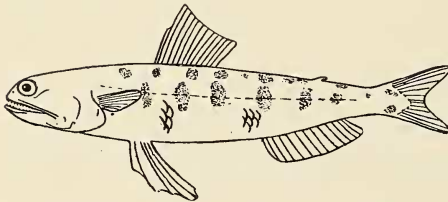
Cylindrical, elongate fishes with a single soft-rayed back fin and a small adipose fin near the tail. Mouth very large with strong pointed teeth. Color mottled. Ventral fins placed anterior to the back fin instead of about under it as in trout and smelt.

Head short, blunt, compressed.

*Trachinocephalus*

Head depressed, with flat triangular snout.

*Synodus*



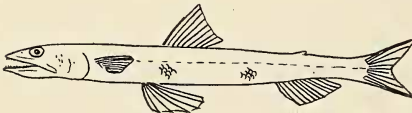
#### 56. Snake-fish

*Trachinocephalus myops* (Forster)

**DISTRIBUTION:** A straggler from the south in summer and fall, July to October. *Woods Hole*, rare, recorded for July, September and October.

Occurs in the West Indian fauna from South Carolina to Brazil, occasionally north to our region.

**SIZE:** Reaches a length of about 9 inches.



#### 57. Lizard Fish

*Synodus foetens* (Linnaeus)

**DISTRIBUTION:** A straggler from the south, usually rare, occasionally rather common to the westward. September to October 30. *Woods Hole*, a few nearly every year during September. *Orient*, once, October 9. *New York*, October, to October 30. *Sandy Hook Bay*, September 22, 1926 three examples  $5\frac{1}{4}$  inches standard length.

Occurs on sandy shores from Cape Cod to Brazil, very common from South Carolina southward.

The lizard fish is mottled in color to match the sandy bottom on which it lies in shallow water, darting swiftly on small fishes which chance to pass its way.

**LIFE HISTORY:** At a length of 40 mm. (standard) the young are translucent with six pairs of oval pigment spots placed one on each side of the ventral mid-line.

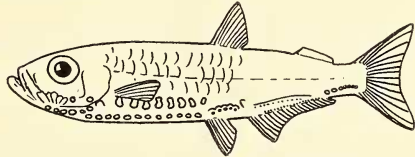
**SIZE:** Reaches 12 inches total length (Orient).

### LANTERN FISHES

Small fishes of the open sea, usually silvery in color, with rows of luminous spots along their lower surfaces, which shine like glass beads, and can emit phosphorescent light at night. A soft-rayed fin on the back, and frequently an adipose fin behind it. Eyes and mouths usually large. A varied group that has been separated into several families.

#### 58. Pearlsides

*Maurollicus pennanti* (Walbaum)



A single dorsal fin of 11 or 12 rays nearer tail than snout, its last ray over origin of much longer anal. A low, inconspicuous, adipose fin. Mouth large, the maxillary produced backward. A series of luminous spots along the lower side of head, body and tail. Scales rather large, deciduous, usually lacking in dead specimens. Depth 4 in standard length.

**DISTRIBUTION:** *Woods Hole*, picked up dead on the beaches, one in January 1884, and 21 specimens collected by Edwards, November 27, 1906.

Occurs widely distributed on the open seas. This is the only species of the diverse lantern fishes of which we have record for the region. It is included on the supposition that it is pelagic rather than abyssal, coming to or near the surface at night. Several other species should occur but are so far unrecorded.

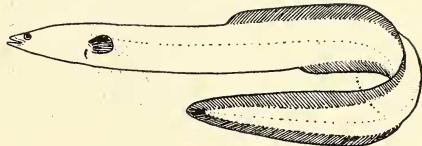
**SIZE:** Reaches a length of 2 or 3 inches.

### EELS.

The true eels have a rather large mouth with short, strong teeth; the lower jaw the longer; well developed pectoral fins, and the body covered with small, imbedded linear scales arranged in groups, at right angles to one another. These can only be clearly made out with a magnifying glass.

#### 59. Common Eel

*Anguilla rostrata* Le Sueur



**DISTRIBUTION:** Abundant resident everywhere, particularly in shallow, weedy, or muddy water. Hibernates in mud with the first frost (Orient).

Occurs from the Gulf of St. Lawrence to Mexico and the West Indies, and even Brazil, entering Atlantic and Gulf drainage.

The common eel is found in both salt and fresh water, penetrating to almost every muddy little pond or stream in the interior of the country. It breeds, nevertheless, only in the deep sea. "Silver Eels" individuals with silvery sides have never been taken from the mud in Orient, although common in the fall run.

**FOOD:** Feeds on shrimps, crabs, mollusks, worms, small fishes, etc., also sometimes a scavenger.

**LIFE HISTORY:** The development of the common eel, long a mystery to both naturalist and layman, is now fairly well understood, by the former at least, although no doubt the countryman will continue to explain that loose horse hairs come to life if dropped in water, and showing *Gordius* as evidence, will boldly state that these will eventually become eels fit for consumption.

Such is not the case, however, and we know the eel to be a catadromous species, that is, one which descends to the sea for the purpose of spawning. All during the warmer months this downstream migration takes place and it is doubtful if a return is ever made as we have no record of large eels migrating upstream. They eventually find their way to an area of oceanic waters southwest of the Bermudas. The minute ova are thus extruded in mid-ocean and hatch into very uneel-like larvae—the *Leptocephalus*. This creature is cigar shaped in outline, but extremely flat, and so transparent as to make it very difficult to see. From the time of hatching, which is in the fall, the young eels gradually work back to the continent, being assisted by favorable currents. By the time they reach our coasts they are out of the *Leptocephalus* stage and have the general form of the mature eel, although they are still highly transparent. During April these are common in the bays and inlets of our territory and average about 53 mm. in length. On account of their extreme low visibility they are not so well known then as they are a little later when pigment darkens them and they begin to pass upstream. At this time it is almost impossible for them to escape notice, so great is their number, every country boy knowing them under the name of elver. Even in such foul cesspools as New York Harbor, they are still to be found in numbers every spring. Urchins of lower New York amuse themselves each year by fishing them out with tin cans along the Battery wall.

Some of these migrating eels eventually find their way far inland. These, so far as known, are always the larger females, as the smaller males remain near the coast in brackish water. The length of their stay in freshwater varies and may be extended to cover many years, landlocked individuals even spending a good portion of man's allotted span in such environments.

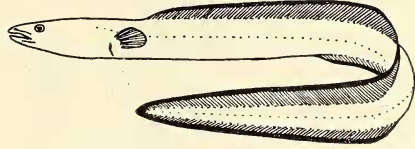
**SIZE:** Reaches a maximum length of 4 or 5 feet; largest Orient specimen taken 6¼ pounds.

## CONGER EELS

Very like the true eels in superficial characters, but lacking scales.

60. **Conger Eel**

*Leptocephalus conger* Linnaeus



**DISTRIBUTION:** Generally common (April 16) May 17 to December 30. Has periods of abundance to the eastward. *Woods Hole*, appears in July and remains till fall (October). Some years common; others rather rare. *Orient*, summer resident, most common in October and November, earliest date April 16. *New York*, uncommon, summer to December 30. *Sandy Hook Bay*, October 11, 1926.

Occurs almost cosmopolitan in warm and temperate seas of the northern hemisphere, but not found in the eastern Pacific.

**FOOD:** Feeds on fish, (herring, butterfish, eel) and worms. The conger eel is found only in salt water, usually not very close to shore.

**LIFE HISTORY:** Like the common eel the conger passes through a ribbon-like, transparent, small-headed, larval *leptocephalus* stage. It spawns but once and then dies, moves off shore to spawn, and ripening of the sexual products is accompanied by changes in the shape of the head, loss of the teeth, etc., while the eyes of the male become enormous. The number of eggs produced has been estimated at from 3 to 6 millions.

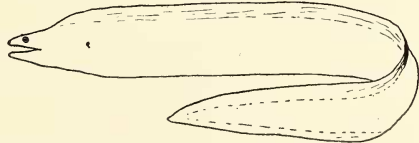
**SIZE:** Largest recorded specimen caught at Falmouth, weighed 12 pounds. Reaches a length of 8 ft.

## MORAYS

Shore eels without pectoral fins, and without tongues. Body compressed. Gill opening small and rounded, dorsal and anal fins continuous as a fringe around the tip of the tail. Mouth large with pointed teeth.

61. **Reticulated Moray**

*Mureana retifera* Goode and Bean



**DISTRIBUTION:** One specimen, 6 feet 2 inches long, weighing 39 pounds, taken in a lobster pot at Tuckernuck Island, July 25, 1899.—H. M. Smith.

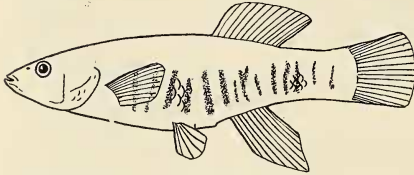
Occurs off the coast of South Carolina in rather deep water.

## KILLIFISHES

Small, coastal, shallow-water, salt or brackish water fishes, with a small transverse mouth with small teeth; single soft rayed dorsal fin behind middle of back, and squarish or rounded caudal fin.

Teeth all pointed in bands.  
 Teeth all pointed in a single series.  
 Teeth incisor-like, tricuspid, in one row.

*Fundulus*  
*Lucania*  
*Cyprinodon*



**62. Striped Killifish**  
*Fundulus majalis* (Walbaum)

The head of the striped killy as seen from above, is rather pointed. Its sides are whitish—a color never approximated by the common killy—and marked with bold, black streaks; vertical in the male (as in the figure), horizontal in the female.

**DISTRIBUTION:** Abundant resident in shallow water throughout the region *Woods Hole*, abundant resident. *Orient*, abundant resident, taken from mud in coldest parts of winter. *New York*, abundant resident.

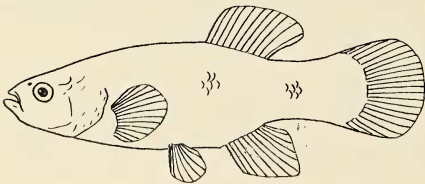
Occurs from Cape Cod to Florida, less numerous southward, and replaced on the Gulf Coast by related species.

Swims in loosely organized schools of varying size, along sandy or pebbly shores of ocean, sound or bay, and a few scattered individuals are usually to be found, and it is sometimes abundant, associated with common killifish in weedy or muddy waters of bay and marsh.

**LIFE HISTORY:** Spawning schools swim in still, shallow water close to the shore line in summer. The males now assume very handsome colors, clear yellow shades on the fins and a dark mark on the side of the head. Begins spawning in June; ripe males and females taken in Sandy Hook Bay, June 1 to 23. Fertile spawn obtainable throughout July and early August at *Woods Hole*.

The eggs, sometimes laid in sand 3 or 4 inches deep are spherical, deep amber in color and slightly adhesive. They average about 2.16 mm. in diameter. Development is gradual, the fish not leaving the egg until it is a post larva, which at a temperature of 65° F. takes about 58 days. It hatches as a well developed fish, with its full complement of fins substantially as in the adult. About nine days after fertilization peristaltic movements of the cardiac dilation are regular and readily observable.

**SIZE:** Reaches a total length of 7 inches (*Orient*), occasionally even 8 inches.



**63. Common Killifish**  
*Fundulus heteroclitus macrolepidotus*  
 (Walbaum)



The head of the common killy is broad and blunt, viewed from above, and generally the sides have no noticeable streaks, though sometimes comparatively light or dark vertical ones are present. The scales in a lengthwise series number 35 to 38.

**DISTRIBUTION:** Abundant permanent resident, in shallow water throughout the region. *Woods Hole*, abundant resident. *Orient*, abundant resident. *New York*, abundant resident.

Occurs from the Gulf of St. Lawrence to the Gulf of Mexico, everywhere abundant. Three geographical races can be differentiated, our northern one is *F. h. macrolepidotus*, *F. h. heteroclitus* occurs in the Carolinas, *F. h. grandis* (commonly reaching a length of 6 inches) from Florida to Texas.

Particularly abundant in weedy or muddy shallows of bay and marsh, running freely into brackish to almost pure fresh water, and thriving on pollution.

The common killifish, also called mummichog, is probably the most abundant small fish in this vicinity. This name, sometimes shortened to "mummy," is of Indian derivation, and signifies "going in crowds." It swarms in shallow, salt and brackish water and very frequently a specimen will be found in quite fresh water. It benefits mankind by destroying quantities of mosquito larvae. It can undergo great changes in temperature and salinity and will live in water too foul for other species, and for a considerable time out of the water altogether. In fact, of all our fishes, it is one of the most tenacious of life.

This species is probably particularly prone to occur in fresh water in early spring, when this may be expected to be warmer and with more abundant feed than the adjacent salt or brackish areas. On March 23 (1924, J. T. N.) where the source of a brackish creek ran out of a swamp at Mastic, L. I., 'as a narrow muddy gutter beneath the bushes, many *Fundulus* were churning the edges of same, and of 13 taken with a random scoop of an old basket, one was a *heteroclitus* about  $3\frac{1}{2}$  inches total length, 10 were *heteroclitus*  $1\frac{1}{2}$  to  $2\frac{1}{4}$  inches, 2 were *diaphanus*  $1\frac{3}{8}$  to  $2\frac{1}{2}$  inches; though there is no chance of any taint of sea water here.' *Heteroclitus* is rare, if it occurs at all, in this part of the creek in summer, though of course abundant in the broader slightly brackish portions of same nearer the bay.

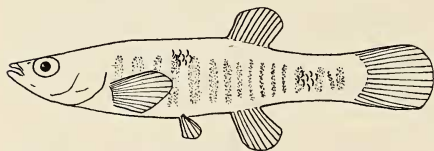
**FOOD:** As nearly omnivorous as its small size will permit, eating enormous numbers of diatoms and Foraminifera, feeding on small crustacea, mollusks, insect larvae, and even fishes, also a variety of vegetable matter, eel-grass, etc.

**LIFE HISTORY:** Males assume bright colors when spawning as follows: blue black, more or less marked, especially posteriorly, with narrow whitish cross-bars and pinkish white spots. Lower half of opercle, belly, ventrals, edges of anal, caudal and dorsal bright yellow. Dorsal with a black spot posteriorly. At the same time females have the ordinary dull colors,—olive brown, practically unmarked, belly pearl; usually with narrow blackish cross-bars more or less distinct, especially posteriorly. Males with nuptial colors occur as early as April 27 (Mastic, Long Island): Spawning takes place in grassy or weedy shallows in salt, brackish, or almost fresh water.

Ripe spawn has been taken as early as the middle of May and as late as early August. Young of all sizes intermingle during the summer. Cross-fertilization has been effected between this species and *F. majalis*. Spawning (in salt or brackish water) may be in excited crowds splashing in the shallows, or singly, as per the following observation. June 18, in shallow brackish water over a hard bottom with thin coating of mud, weed growing here and there. Occasionally two *F. heteroclitus* would dart in across a weedy strip. The larger of the two was a dark bluish male, the other pale olive in color, doubtless a female. When she poised in the water he would range alongside of her, and when she darted away follow swiftly after. Once she went to the bottom for a moment or two, where her consort pressed down and against her, leaning over her and trembling with spread fins.

The eggs are spherical, amber in color and slightly adhesive. They average about 1.97 mm. in diameter. Development is gradual, the fish not leaving the egg until it is a post larva, which at a temperature of about 65° F takes about 40 days. About six days after fertilization peristaltic movements of the cardiac dilation are regular and readily observable.

SIZE: 4 or 5 inches long.



64. Fresh-water Killifish  
*Fundulus diaphanus* (Le Sueur)

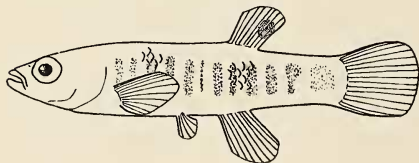
Resembles the common killifish somewhat, but the head is less blunt, scales smaller, about 45 instead of 35 to 38.

DISTRIBUTION: Common in small streams close to salt water. To the westward we have never found it in other than fresh-water. *Woods Hole*, a brackish and fresh-water species, seldom or never found in undiluted sea water.

Occurs in streams and lakes from the coast of Maine to Cape Hatteras, abundant near salt water.

Where it occurs in the narrow running fresh water heads of brackish creeks this species is rather sparsely distributed, seldom more than 3 or 4 individuals swimming together. They hang poised in the water and dart away swiftly when alarmed, giving the impression of a distinctly faster fish than *heteroclitus*.

SIZE: 4 or 5 inches long.



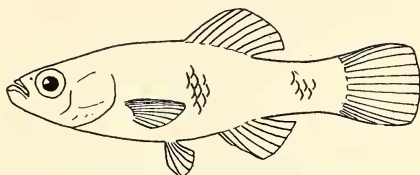
65. Lucy's Killifish  
*Fundulus luciae* (Baird)

Insertion of the dorsal fin behind, not before or above that of the anal, as in the preceding three species; dorsal with 8, anal with 10 rays; scales about 35.

**DISTRIBUTION:** Occasional in July on the New Jersey coast. Occurs from Long Island to Virginia, rare.

**66. Rain-water Fish**

*Lucania parva* (Baird and Girard)



The rain-water fish, very seldom reaching a length of 2 inches, may be recognized by the dark edges of the scales, which make them stand out prominently. Aside from the sheepshead minnow, it is deeper than others of its relatives occurring locally, the depth contained only slightly more than 3 times in the length. A small dark mark at the base of the back fin in front is characteristic, though not always present.

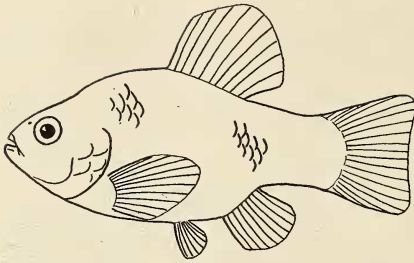
**DISTRIBUTION:** Fairly common resident in shallow weedy coastal fresh and brackish water, easily overlooked. We have no knowledge of its occurrence on the south shores of Long Island Sound. *Woods Hole*, fairly common, resident, brackish water. *New York*, very locally common, brackish water.

Occurs on the Atlantic Coast from Connecticut to Key West, with a preference for brackish water. In Florida it is abundant in pure sea water. At times becomes very abundant among water weed in fresh or slightly brackish waters tributary to Moriches Bay, Long Island.

May be kept successfully and will breed in balanced aquaria. When several are placed in a tank they at first swim about in a more or less compact school, but when they become accustomed to their surroundings scatter about the tank. They are moderately active and take their food indifferently at the surface, at the bottom or in mid water. They show good spirit, frequently chasing one another, but are not bad fighters.

**LIFE HISTORY:** Has spawned in an aquarium with abundant and fine vegetation, water temperature about 64°, in late February; incubation period about 2 weeks. From 3 weeks or so after hatching, about  $\frac{1}{4}$  inch total length, the young resemble adults but are more slender with proportionately larger caudal fins.

**SIZE:** Reaches a length of 2 inches.



## 67. Broad Killifish

*Cyprinodon variegatus* Lacépède

The Sheepshead Minnow may be recognized by its great breadth, contained from two to two and two-third times in the length from tip of snout to base of tail fin. Breeding males are bright steel blue and orange. Females and young dull colored with irregular vertical marks.

**DISTRIBUTION:** Resident, abundant, particularly to the westward. *Woods Hole*, resident, locally abundant, generally not uncommon. *Orient*, common resident. *New York*, abundant, resident.

Occurs from Cape Cod to the Gulf Coast, very abundant southward, a distinguishable race, *C. v. riverendi* in the Florida Keys and Cuba.

**LIFE HISTORY:** Males with bright blue and orange breeding colors seen from June 1 to 23, and fish apparently spent taken on July 14 and 22 (*Sandy Hook Bay*). Spawns in June and ripe eggs recorded July 13 (*Woods Hole*).

In the breeding season males are commonly found several together, swimming actively about, fighting and chasing one another in circles, their steel-blue backs flashing. In one such case where no females were present a male was observed to go repeatedly to the bottom and wriggle vigorously with its belly against the mud so that little clouds of the same rose on either side (*Mastic*, June 18).

In the waters around New York City the males of the broad killifish acquire their brilliant nuptial coloration concomitantly with the development of the female roe, in the late spring and early summer, although ripe fish are sometimes seen as early as May or as late as September. Spawning frequently takes place in the shallow and usually brackish arms of the smaller bays. The larger tide pools which become landlocked at low tide either entrap considerable numbers of them in their search for a suitable spawning place or they choose them by preference. At least they are generally to be found in the largest numbers in such places amid sea wrack and general debris in company with the more abundant common and striped killifish.

The spawn is not all deposited at one time, a few eggs being laid daily for some period of time or a number may be laid at a time with longer intervals intervening. The eggs are spherical and of a translucent yellowish color. They vary from 1.2 to 1.4 mm. in diameter, sink in sea water and owing to the possession of numerous adhesive threads adhere to each other or any



submerged object on the slightest touch. They hatch in from 5 to 6 days at a temperature of about 60° F. into quite well developed larvae although the primitive fin fold is still present. The newly hatched fry measure about 4 mm. in length. Five days later the yolk is practically gone. By the time a length of 10 mm. is reached most of the diagnostic characters of the adult have been acquired. Probably maturity is reached at the age of one year. The average size for females is about 45 mm. and for males about 48 mm. The sexes appear usually in about equal numbers.

SIZE: Reaches about 2½ inches standard, 3 inches total length.

### NEEDLEFISHES

Slender, elongate fishes with silvery sides, swimming swiftly at the surface. Jaws of approximately equal length prolonged in a beak, set with pointed teeth.

Body more or less cylindrical.

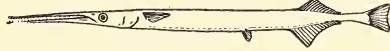
*Tylosurus*

Body much compressed, flattened from side to side.

*Ablennes*

#### 68. Bill-fish

*Tylosurus marinus* (Walbaum)



Dorsal and anal fins short, each with about 13 developed rays. Caudal almost equally lunate; peduncular keel inconspicuous. A dark vertical bar on the side of the head.

DISTRIBUTION: Common summer resident, May 7 to December. *Woods Hole*, May to October. *Orient*, May 7 to November 20. *New York*, common, June to December.

Occurs abundantly from Cape Cod to Texas, casual in Maine.

The bill-fish, abundant with us in summer, inhabits salt water, and also enters the mouths of fresh rivers and creeks, swimming in small schools at the surface and preying on other smaller fishes, especially the common silverside. It reaches a length of 4 feet, but is usually much smaller. It is transparent green in color with silvery sides.

This species has the interesting habit of launching itself out of water and skipping over the surface as might a lance or spear. It is a habit shared by others of its elongate relatives which are represented by numerous species in tropical waters. A common species with a flattened body (*Ablennes hians*) is especially noteworthy as a leaper and can cover considerable distances by turning on its side and letting the air or water strike against its flattened surface. One of the most noteworthy specializations of structure which occur in fishes and serve definite habits is found in the flying fish, which is allied to the billfish and halfbeak. The elongated and strengthened breast fins of the flying fish, which when folded extend backward almost or quite to the tail, are spread when the fish leaps from the water, supporting it for protracted journeys through the air. But there seems little doubt that the leaping habit was common to the group before the flying fish developed its wings and in this case at least the habit preceded the correlated structure.



**FOOD:** Eats fish and shrimp (*Woods Hole*).

**LIFE HISTORY:** Often ascends rivers far above tide water and probably breeds in fresh as well as brackish and salt water.

While usually not seen in Sandy Hook Bay before September, in 1923 they appeared early and were of correspondingly small size. Below is given the average lengths of the individuals taken in serial collections from one place in the Bay. It is taken that they represent catches from a group of fishes spawned at approximately the same time and therefore the table is considered a good index of the rate of growth in these waters.

Date Collected		Average Standard Length
July	25, 1923	105 mm.
August	2, "	165 "
"	9, "	190 "
"	16, "	210 "
"	23, "	215 "
"	30, "	245 "

**SIZE:** Recorded up to 28 inches total length (*Orient*) and *Jordan & Evermann* give 4 feet.



#### 69. Houndfish

*Tylosurus acus* (Lacépède)

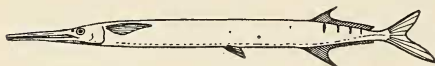
Dorsal and anal fins long, each with over 20 developed rays. Lower lobe of caudal decidedly the longer; a conspicuous black keel on the peduncle.

**DISTRIBUTION:** Of casual occurrence to the eastward. *Woods Hole*, rare or casual, a specimen 4 feet long dated July 27, 1886.

Occurs in the Mediterranean and the West Indies, occasionally straying northward.

**LIFE HISTORY:** The young of this species apparently follow drifting off-shore weed, instead of swimming actively in close under the mangroves as do those of some. One about 6 inches long so identified was scooped with drifting gulf-weed in Biscayne Bay, Florida, April 20, 1917. It was cylindrical and slender, caudal unequally forked. Bright silvery, translucent, with broad very indistinct dark bars on side, back darker. Dorsal high posteriorly, black. A black peduncular keel slightly developed. Beak from eye 2 times rest of head. Dorsal rays 24.

**SIZE:** Reaches a length of 6 feet or more.



#### 70. Flat Needlefish

*Ablennes hians* (Cuvier and Valenciennes)

**DISTRIBUTION:** Accidental, twice. *Woods Hole*, summer of 1895, and August 14, 1902.

Occurs in the West Indian fauna from Florida to Brazil, generally common.

**SIZE:** Reaches a length of 5 feet.

## THE HALFBEAKS

Silvery, elongate fishes, resembling the needlefishes, but the upper jaw short. The lower jaw only prolonged in a long, spear-like point without teeth.

- a. Body slender, band shaped; pectoral fins very long *Euleptorhamphus*  
Body moderately slender and compressed, pectorals moderate. (See b.)
- b. Ventrals far in advance of dorsal. *Hyporhamphus*  
Ventrals not far in advance of dorsal. *Hemiramphus*

## 71. Common Halfbeak

*Hyporhamphus roberti* (Cuvier and Valenciennes)



DISTRIBUTION: Common summer resident to the eastward, varying in numbers, uncommon to the westward. June 10 to Nov. 7. *Woods Hole*, common to abundant, July, August and September. *Orient*, not uncommon June 10 to November 7. *New York*, uncommon, August to October 16.

Occurs on both Atlantic and Pacific Coasts of America, from *Woods Hole* (casually Maine) to Florida and New Orleans, Mazatlan to the Galapagos. Represented by the closely related *H. unifasciatus* in the strictly West Indian fauna, including the Florida Keys.

SIZE: Reaches 12½ inches in total length (*Orient*).

## 72. Ballyhoo

*Hemiramphus brasiliensis* (Linnaeus)



DISTRIBUTION: Accidental, one record. *Woods Hole*, August 9, 1898.

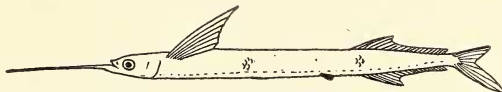
Occurs in the West Indian fauna, Key West to Bahia.

FOOD: The ballyhoo feeds chiefly on algae.

SIZE: Length 15 inches.

## 73. Flying Halfbeak

*Euleptorhamphus velox* Poey



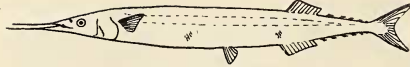
DISTRIBUTION: Accidental, two records. *Woods Hole*, Newport (Goode), off Nantucket (Putnam).

Occurs in the West Indies, rare, occasionally northward in the Gulf Stream to Massachusetts.

SIZE: Reaches a length of about feet 2.

## SKIPPERS.

Slender, flat, silvery fishes, with jaws produced in a slender beak. Soft dorsal and anal fins opposite, far back, several mackerel-like finlets between each and the forked caudal.



## 74. Skipper

*Scomberesox saurus* (Walbaum)

**DISTRIBUTION:** August to December, rare and irregular, occasionally not uncommon, known from as far west as Fire Island. *Woods Hole*, usually very rare, in occasional years more numerous, records for August September and December. *Orient*, rare and irregular, September 21, 1910 (25 taken), September 27 and November 2, 3 and 18. New York, 1, Fire Island Beach, about 2 miles east of light, August 9, 1923, Fred. M. Schott.

Occurs off shore in temperate parts of the Atlantic, rather common north of Cape Cod and France.

This is an off-shore fish swimming in great schools at or near the surface. It is preyed upon by larger predaceous fishes such as pollack and bluefish, also by porpoises. It frequently strands on the beaches, probably in an effort to escape such enemies, to which may also be ascribed its habit of leaping out of water, often in schools.

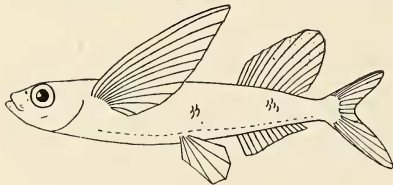
**LIFE HISTORY.**—The skipper spawns in the open sea. Its fry are abundant at the surface in the Atlantic between 11° or 12° and 40° North. Their jaws do not commence to elongate until the fish have attained a length of about 40 mm. The lower jaw grows faster than the upper at first so that young 100 to 150 mm. in length look like half beaks.

**SIZE:** Reaches 30 inches (Miami, Mowbray); 14 inches total length recorded from Orient; Bigelow and Welsh give up to 18 inches.

## FLYING-FISHES

Small mouthed; large eyed; large scaled, silvery, herring-like fishes with deeply forked tail fins, the lower prong of the fork the longer. Body usually not greatly compressed and pectoral fins narrow, strong, and very long, used to support the fish in gliding leaps of considerable distances in the air.

- a. Ventral fins small, nearer tip of snout than base of caudal. *Halocypselus*  
Ventral fins longer, at or behind middle of body (see b).
- b. Pectoral fin moderate, not reaching beyond middle of dorsal, body elliptical in cross-section. *Parexocoetus*  
Pectoral fin long, body angular in cross-section (see c).
- c. Anal fin shorter, its base considerably less than that of dorsal, its rays 9 or 10. *Cypselurus*  
Anal fin longer, its base little less than that of dorsal, its rays 11 or 12. *Exonautes*



## 75. Short-winged Flyingfish

*Parexocoetus mesogaster* (Bloch)

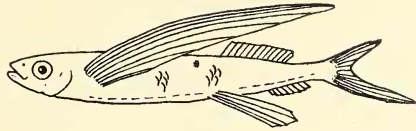
DISTRIBUTION: Accidental, one record, Newport.

Occurs cosmopolitan in tropical seas, northward in the Gulf Stream, the commonest Flying-fish off the Carolinas.

SIZE: Reaches 7 inches in length.

**76. Atlantic Flyingfish**

*Cypselurus heterurus* (Rafinesque)



Resembles *C. furcatus*. Pectorals less boldly marked; dorsal and anal without black.

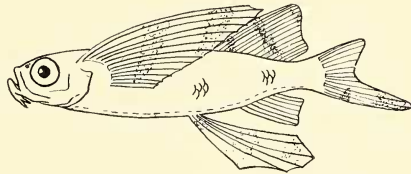
DISTRIBUTION: Uncommon in summer, rare to the westward. *Woods Hole*, probably the commonest flying-fish, several definite records, July 10 to August 21. *New York*, recorded. One 12 inch specimen (total length) taken in Great South Bay August 18, 1926.

Occurs in the Atlantic Ocean, generally common southward on both coasts, straying north to the banks of Newfoundland and to England.

SIZE: Reaches 15 inches in length.

**77. Spot-fin Flyingfish**

*Cypselurus furcatus* (Mitchill)



Second ray of pectoral divided (first simple). Third and fourth rays longest. Pectorals blackish with a broad diagonal white band; dorsal and anal marked with black.

DISTRIBUTION: Accidental, recorded from Newport and near New York City.

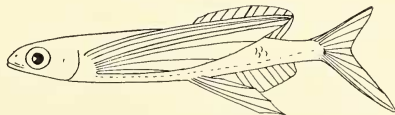
Occurs in warm seas, north to the Mediterranean, straying to Cape Cod.

LIFE HISTORY: The young of this flying fish (the species was based on such a young individual by Mitchill) have a large eye, comparatively short pectoral, large ventral, and a double barbel at the chin. They possess a variegated black white and yellowish color and occur with drifting gulf weed up to a total length of at least 85 mm. (over  $3\frac{1}{4}$  inches).

SIZE: Reaches 6 inches in length.

**78. Blunt-nosed Flyingfish**

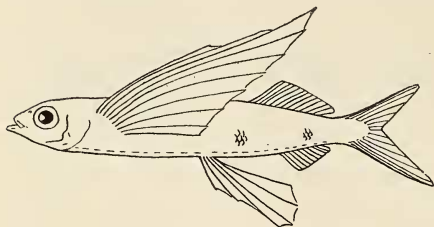
*Cypselurus gibbifrons* (Cuvier and Valenciennes)



Second ray of pectoral simple, like the first, third ray divided, snout very blunt, obtusely descending.

**DISTRIBUTION:** Accidental, recorded from Newport.

Occurs in the Atlantic, only two specimens known.



**79. Four-winged Flyingfish**

*Exonauetes affinis* (Günther)

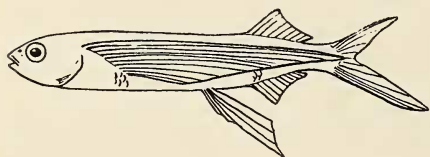
Pectoral fins blackish with a broad diagonal white stripe.

**DISTRIBUTION:** Rare, mostly to the eastward. *Woods Hole*, of variable frequency but usually scarce. *New York*, accidental. Due to varying interpretation given Linnaeus' "*Exocoetus volitans*" at different times, it is not certain that the above data really applies to this species, which in any event is to be expected as a rare straggler in our region.

Occurs in the Atlantic, or cosmopolitan in tropical and subtropical seas if the same as *E. speculiger*, which is likely North in the Gulf Stream.

This is one of the flying-fishes, characteristic of the open sea, occurring often in large schools and trusting to their power of flight to escape predacious oceanic bonitos and dolphins of which they form the principal food.

**SIZE:** Reaches 12 inches in total length, usually smaller.



**80. Black-winged Flyingfish**

*Exonauetes rondeletii* (Cuvier and Valenciennes)

Pectoral fins uniform dusky.

**DISTRIBUTION:** Accidental. *Woods Hole*, one or two records? August 7, 1886, and October 13, 1900. Although a question has been raised as to the validity of our records, the species is to be expected as a casual or accidental, and would not easily be mistaken.

Occurs cosmopolitan in tropical seas, north to Florida.

This is one of the commonest large, off shore, cosmopolitan species of flying-fishes. Its longest flights above the surface of the ocean have been estimated at one-eighth of a mile.

The lower lobe of the flying-fish's forked caudal fin is the longer and very strong, doubtless of service in launching the fish at the beginning of its flight. When it leaves the water pectoral fins (wings) and ventrals also,



when these are enlarged and posterior in position, are spread stiffly as planes, and not infrequently a rapid vibrating movement of the pectorals through a narrow arc can be observed as the flight commences.

The longest flights start more or less into the wind and curve off before it, the maximum elevation of some 10 or 20 feet being attained with the wind abeam. At their close the fish may either plunge into the water or drop down so that the lower caudal lobe cuts the surface, and sculling vigorously again throws the fish into the air, and the original flight may thus be repeated once or twice with diminishing distances before the fish goes under.

Flying-fishes are the commonest, an almost omnipresent form of fish-life over the broad trade wind belts of the ocean. They fly primarily to escape pursuing predaceous fishes, and alarmed by a ship rise and scatter before her bows 'like grasshoppers in a meadow.' They also are most in evidence and make the longest flights when there is a fresh breeze blowing, at such times taking the air, the smaller species in flocks, apparently for sport. At night individuals frequently cross a ship, strike against the rigging and fall to the deck, to appear next morning as a table delicacy fried in corn meal or bread crumbs. This very rarely happens in the day time, and it is evident that they can see where they are going above water and control their direction to some extent by banking (leaning to the side).

There has been considerable discussion as to the part played by wing-motion in maintaining and propelling the flying fish in the air. It is now rather generally conceded that such part is slight, and motion observed referable to muscular tension in setting the wings, 'warbling' of same in the wind, or some such cause. The structure and proportions of the flying-fish have been analyzed from an aeronautical point of view showing it to be a very efficient glider, and observations would indicate that in addition to the initial impulse attained in the water it also utilizes the internal energy of the air (wind). While in agreement with this point of view we hesitate to discard wing-motion entirely as a factor if an insignificant one, particularly for small individuals an inch or so in length, the wings of which have been observed to be in constant rapid motion like those of an insect during their very short flights.

SIZE: Reaches 11 inches or more in length.

### STICKLEBACKS

Very small fishes of fresh, brackish, and salt water. Mouth small, eye large. Several stout disconnected spines on the back, in front of the soft rayed dorsal fin. Ventral fins with similar spines. Caudal fin rounded or squarish.

Dorsal spines 8 to 11.

Dorsal spines 3.

Dorsal spines 4, divergent.

*Pygosteus*  
*Gasterosteus*  
*Apeltes*



81. **Ten-spined Stickleback**  
*Pygosteus pungitius* (Linnaeus)

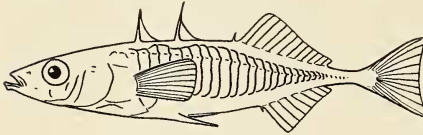
**DISTRIBUTION:** Common resident. *Woods Hole*, common resident. *Orient*, resident. *New York*, common resident.

Occurs circum-polar in fresh and brackish water, south to Long Island. Frequents weedy brackish water at the heads of harbors.

**LIFE HISTORY:** Spawns in April and May (*Woods Hole*).

The male often but not always, builds a nest attached to grass or weeds, in which the female spawns. He guards nest or eggs until they hatch in about 12 days into fry about 6 mm. long.

**SIZE:** Reaches 3 inches.

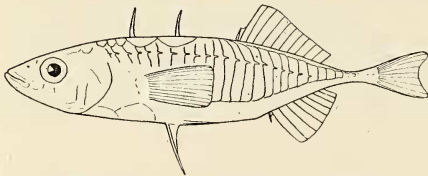


82. **European Stickleback**  
*Gasterosteus aculeatus* Linnaeus

**DISTRIBUTION:** The common resident *Gasterosteus* at *Woods Hole* is recorded as this rather than the following form. *Woods Hole*, common resident, most abundant in March and April.

Occurs in the coasts and streams of northern Europe, also said to be the common resident form in New England, extending south to New Jersey.

**LIFE HISTORY:** Breeds in May and early June (*Woods Hole*).



83. **Two-spined Stickleback**  
*Gasterosteus bispinosus* Walbaum

**DISTRIBUTION:** Common resident. *Woods Hole*, fairly common in summer. *Orient*, common resident. *New York*, common resident.

Occurs on our Atlantic coast, south to New Jersey. To what extent it is replaced, especially on the coast of New England and the provinces, by *aculeatus* is uncertain. Found in salt and slightly brackish water. Its food consists of small animals (fish, fish-eggs, crustacea and other invertebrates) and plants (diatoms). It is usually to be found in shallow water among eel grass or seaweed.

**LIFE HISTORY:** A spent female of 40 mm. in standard length and a number of young which followed her were scooped up in the Horseshoe, Sandy Hook Bay, over a depth of about eight feet, fully an eighth of a mile from the

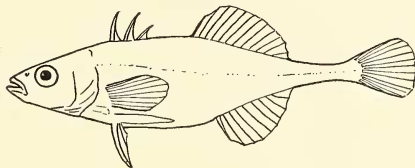
nearest clump of *Zostera*, on June 7. The young fishes (39 of which were taken by the single dip of the net which entrapped the elder one) ranged from 14 to 17.5 mm. in standard length and displayed a modal length of 16. The possibility of parental care on the part of the female was thus forcibly suggested. In this same locality ripe adults in the latter part of May and early June average, females 56 mm., and males 52 mm. standard length.

In general the spawning habits in this genus (*Gasterosteus*) are as follows. In spring or early summer males assume bright breeding colors and fight fiercely among themselves. In a sheltered spot the male builds a nest, a barrel-shaped mass of bits of grass, etc. weighted down with pebbles and cemented together with mucous threads secreted by his kidneys, which nest is an inch or so in diameter. To it he escorts one or a succession of females, each of them depositing 100 or 150 eggs in the central cavity, which stick in clumps to one another and to the nest. The male enters the nest to fertilize the eggs, and guards it jealously against all intruders for the week or ten days it takes the eggs to hatch, then tears it down, but continues to guard the young until they can shift for themselves, at hatching they are between 4 and 5 mm. long, when 6 weeks old about 15 mm., resembling the adult in form.

SIZE: Reaches 4 inches in length.

#### 84. Four-spined Stickleback

*Apeltes quadracus* (Mitchill)



DISTRIBUTION: Abundant resident. The most generally distributed of our sticklebacks, and the commonest in salt water. *Woods Hole*, very common, resident. *Orient*, common resident, collects in large schools in the Sound in November and December. *New York*, abundant resident.

Occurs from New Brunswick and Nova Scotia to Virginia, abundant northward.

Primarily a salt water species, but enters brackish or even fresh-water.

FOOD: Feeds on copepods (*Woods Hole*).

LIFE HISTORY: The four-spined stickleback spawns during May, June and July in the vicinity of New York, and usually in brackish water. Ripe fish are quite common along the bay side of Sandy Hook during these months.

The eggs are spherical, adhesive and demersal, more yellowish in color than those of *G. aculeatus* and have an average diameter of 1.6 mm. They hatch in six days at a temperature of 22° C. The newly hatched larvae are from 4.2 to 4.5 mm. in length, and are very similar to those of *G. aculeatus* of the same stage, but are more heavily pigmented.

As is usual with this family the eggs are cared for by the paternal parent

with what seemingly almost amounts to intelligence. In this particular species a nest is built by the male which is bound together by means of threads formed from exudations of a pore near the vent. The nest when completed measures about half an inch in height and about three-eighths of an inch in diameter, and has an opening at the top through which the eggs are introduced. The eggs and young are attended for some time by the male. As in all animals which protect their offspring, the number is comparatively reduced, the females of this fish not ordinarily laying more than twenty-five eggs.

SIZE:  $1\frac{1}{2}$  to  $2\frac{1}{2}$  inches in length. In Sandy Hook Bay the largest taken measured  $1\frac{3}{4}$  inches standard length, although the adults do not average over  $1\frac{3}{16}$  inches.

#### TRUMPET-FISHES.

Silvery and elongate, free swimming fishes with inconspicuous minute scales. The snout is prolonged so as to suggest the beak of a needlefish, but tubular with a small mouth at its end. Caudal fin forked, with a whip-lash arising from the center of the fork.



85. Trumpet-fish  
*Fistularia tabacaria* Linnaeus

DISTRIBUTION: Rare summer visitant, September to early November. *Woods Hole*, a few every year, present in September, October and early November. *New York*, uncommon, September and October, to October 16.

Occurs in the West Indian Fauna, a few straggle northward to Massachusetts.

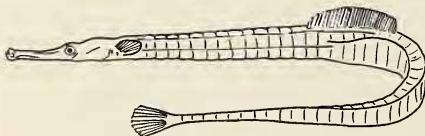
SIZE: Reaches a length of 6 feet, the usual size locally 7 or 8 inches, and largest 20 inches exclusive of caudal (*Woods Hole*).

#### PIPE-FISHES

Small fishes, found hiding among eel-grass and sea-weed, with a more or less elongate tubular snout and small mouth at its end. Body hard, leathery, tubercular, marked off in segments. A delicate, squarish soft-rayed fin on the back. The pipe-fishes proper are very slender and elongate with a delicate, fan-shaped caudal fin. The sea horses are irregular in outline, the tail finless and prehensile.

Slender, head in line with body, caudal fin present.  
Stout, head not in line with body, tail prehensile.

*Syngnathus*  
*Hippocampus*



86. Northern Pipefish  
*Syngnathus fuscus* Storer

DISTRIBUTION: Very common, resident to the east and probably also to the west, though there recorded only in summer. *Woods Hole*, very com-

mon, resident. *Orient*, resident, most common in spring, an early date March 1. *New York*, abundant, June to December 13.

Occurs from Halifax to North Carolina, with center of abundance in our region.

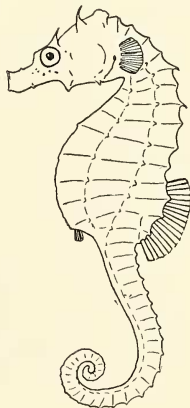
The pipe-fish is not an active swimmer but lurks abundantly among eel-grass and other marine weed and may even be caught in the hand. It usually glides slowly forward, propelled by the dorsal fin, when alarmed attempts swimming in an eel-like manner. Plentiful among eel-grass along shore, also found in the open sounds among floating weed, and dredged at a depth of 17 fathoms (*Woods Hole*).

**Food:** Small crustacea, and to a less extent fish eggs and fry. As well as being concealed by the weed in which it lurks, the pipefish has a rank odor, which may protect it from possible enemies.

**LIFE HISTORY:** The pipe fish may be in breeding condition as early as May 13, and commonly spawns about June 1; males carrying eggs in the brood-pouch found throughout July (*Woods Hole*).

The entire family of which this species is a member are marsupial in habit, that is, they carry their embryos and larvae in a ventrally placed sac especially constituted for that purpose. However, instead of the female assuming the responsibility as in marsupial mammals, it is the males which harbor the offspring. The eggs are apparently fertilized at the moment of transfer from the oviduct of the female to the pouch of the male. Males with eggs or young in their pouches are not rare in this territory during summer. A young example 13 mm. in standard length was taken at the surface in townet just outside of Sandy Hook Bay on June 21, 1921. From individuals kept in aquaria it is known that pipefish reach 70 mm. within about 2 months after hatching. Beyond this the rate of growth and age at maturity is unknown.

**SIZE:** Reaches about 9, occasionally 12 inches total length. A female of 9 inches standard length was taken on August 10, 1923, in Sandy Hook Bay. Size of other adults taken during the same season averaged  $5\frac{3}{8}$  inches.



### 87. Northern Seahorse

*Hippocampus hudsonius* De Kay



**DISTRIBUTION:** Uncommon summer visitant throughout the area. To the westward it becomes comparatively plentiful over periods of several years duration, and perhaps resident, and then becomes rare, following severe winters. *Woods Hole*, a few every year during August and September, earliest July. *Orient*, once only, August (Greenport). *New York*, sometimes common, April to November, casual in winter (February).

Occurs on the Atlantic Coast from Cape Cod (casually Nova Scotia) to Charleston.

**LIFE HISTORY:** The breeding habits of the seahorse are in many ways similar to that of the previously described pipefish, the male assuming the rôle of guardian of the young. Seventy-five or more little seahorses may be liberated from the pouch of a large male.

The males for some days after expelling their offspring, which act is done by pressing the pouch against some solid object, swell out their pouches repeatedly. The function of this action seems to be that of flushing out the brood chamber for the sake of sanitation. The rate of growth is not known. The young on expulsion average about 7 mm. in length as measured if straightened out.

**SIZE:** Commonly reaches a length of about 4 inches. One of about 6 inches, Point O'Woods, L. I., picked up Nov. 30, 1924, Katherine Wager Smith; 7½ inches is the largest on record.

### THE SILVERSIDES

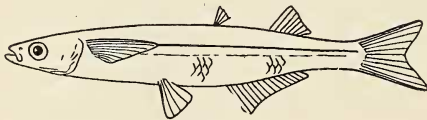
Small, slender, free-swimming fishes with a silvery lateral band and forked caudal fin. A small anterior dorsal fin of a few delicate spines is situated well in advance of a longer soft dorsal. Our species have the jaw of such a structure that the front of the head slants obliquely backward and downward. Lower jaw the longer; mouth small, with teeth.

Scales with comb-like edges.

Scales cycloid.

*Membras*

*Menidia*

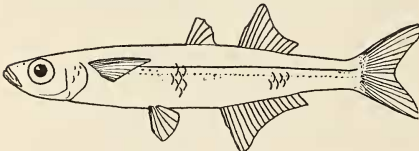


**88. Rough Silverside**

*Membras lacineatus* (Swain)

**DISTRIBUTION:** Casual to the westward. *New York*, casual. Occurs from Virginia to South Carolina, and is replaced further south and west by a closely related species, *Membras vagrans*.

**SIZE:** Reaches a total length of about 4 or 5 inches.



**89. Tide-water Silverside**

*Menidia beryllina* (Cope)

The fresh-water silverside has only about 17 or 18 soft rays in the anal fin instead of 23 as in *M. m. notata*.

**DISTRIBUTION:** Locally abundant, permanent resident to the west in fresh, though entering brackish water. Apparently a summer resident to the east and found also in salt water. *Woods Hole*, shores everywhere, abundant, appearing early in spring; seen as late as December.

Occurs in coastwise Atlantic waters of the United States north to *Woods Hole*, and apparently the same species found up the Mississippi. Abundance and distribution in the Southern States uncertain.

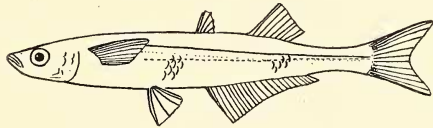
Unlike its salt-water relative, the fresh-water silverside swims in schools which are generally made up of fishes all of about the same size and age. It is also a fatter and less bony fish and fried well is the delicious crisp "whitebait" which we sometimes see on our bills-of-fare. This is a case where differences between two closely related fishes are so slight and technical that the two can be distinguished with certainty only by a naturalist, yet associated with these differences are differences in habits and quality which make of one a prized food fish, the other, though certainly good to eat, a bait fish only.

**LIFE HISTORY:** Spawns in June and July, apparently later than *Menidia m. notata*.

**SIZE:** Reaches a length of up to 3 inches.

### 90. Common Silverside

*Menidia menidia notata* (Mitchill)



Anal fin with about 23 rays.

**DISTRIBUTION:** Abundant resident, perhaps absent in mid-winter to the east. *Woods Hole*, April to December, most abundant late in the fall. *Orient*, resident, abundant only in fall. *New York*, abundant resident, most numerous in late summer and fall.

Occurs on the Atlantic coast of the United States, north to Halifax, Nova Scotia, passing into an allied form *M. m. menidia* to the southward (Virginia southward).

At the apex of fish life in shore waters in late summer and fall, this becomes perhaps the most abundant free swimming species, and is extensively preyed on by fishes and birds (young of blue-fish and mackerel, red-throated loon, etc.).

The common silverside, sometimes called "spiering," is a very abundant species in salt water near New York, and also enters brackish bays and estuaries, occasionally ascends to pure fresh water, and forms an important item of food with predacious fishes everywhere. Large schools made up of silversides of various sizes may be seen in summer time from almost any coastwise dock.

FOOD: Includes vegetable material and diatoms, but mostly carnivorous, eating small crustacea, worms, annelids, mollusks, etc.

LIFE HISTORY: Spawns in June and July, fry 15 mm. in length at surface in July (Woods Hole).

The height of the spawning season of *Menidia* is in June. The place of spawning is in shallow bays, great schools usually congregating for this purpose. Ripe fish are abundant in lower New York bay at this time. The eggs are spherical and vary from 1.1 to 1.2 mm. in diameter. They are yellowish in color, demersal and held together in clumps by the tangled skeins of their adhesive filaments. At a temperature of 72° F. they hatch in eight or nine days. The newly hatched larvae are approximately 5 mm. long. The yolk sac is absorbed before hatching. By the time a length of 15 mm. has been attained the fins are well formed and the young fish are well on their way toward the assumption of adult characters.

Fishes of the running year are taken in Sandy Hook Bay near the end of June with an average length of 20 mm. Fish of the previous year measure about 45 mm. at this same time while mature examples still spawning with a length of 90 mm. are taken as late as the end of July. The season of spawning for this species seems somewhat protracted and a considerable variation in size exists but individuals nearly alike in this respect show some tendency to seek each other's company.

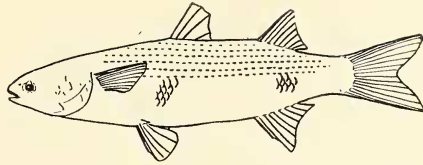
At Chesapeake Beach, Maryland, on the afternoon of April 19, 1908, numerous *Menidia* were spawning in the edge of the water at points where weed and such riff-raff was partially buried in the beach. The tide was rising, probably pretty well up, and the spawning fish were wriggling actively as though stranded in the wash of the ripples which followed one another in, and at times one was almost or quite clear of the water. Close approach to a spot where they were, caused them to disappear from it, and it was difficult to capture any without a net.

Allowing for the difference in latitude it was surprising to find the species spawning here at a date so much earlier than in our more northern region. It has occurred to the writers that the northward flight of transient shore-birds in May may pick up a great many such fish-eggs deposited along the strand tending to advance the season of the southern *Menidia* to April and retard that of the northern to June.

SIZE: 6 inches total length,

#### MULLETS

Small or moderate sized fishes of the bays, with a small transverse, toothless mouth, somewhat on the under side of the head. Body cylindrical and little compressed with moderate sized scales. More or less silvery in color, with well forked caudal fin. Small first dorsal of a few slender spines, separated from the longer and soft rayed second dorsal as in the silversides.

**91. Striped Mullet***Mugil cephalus* Linnaeus

Soft dorsal and anal fins almost scaleless. Sides with dark longitudinal stripes indicated along the rows of scales.

**DISTRIBUTION:** Numerous in late summer and fall. *Woods Hole*, present from June to December, most common in fall. *Orient*, taken in fall and rarely (from mud) in winter. *New York*, common in late summer and fall, said to be a permanent resident, some individuals, at least, hibernating.

Occurs cosmopolitan in temperate and warm seas, from Cape Cod (casually Maine) to Brazil on the east coast of America.

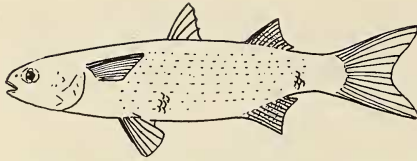
**LIFE HISTORY:** Mullet less than an inch in length are more or less larval or different from the adult. They are compressed, bright silvery with dark backs, have comparatively larger teeth, and only 2 anal spines, what will later become the third spine a simple but articulate soft ray. In this stage they are surface swimmers, and the differences between various species have not been worked out.

The striped mullet apparently spawns in the fall and winter as the appearance of ripe fish is made in New York by about the middle of September. These fish which generally average about 20 cm. are exceedingly fat. They are still present in October. In the spring young are seen about 1 inch long which by the end of summer have reached an average length of about  $2\frac{3}{8}$  inches (standard length). The actual spawning grounds are unknown as is the development of this species. As the mullet ages the intestine becomes progressively more convoluted and longer proportionately, which fact is probably to be correlated to a change in feeding habits of from one of plankton to one containing a high percentage of the higher marine plants. Maturity seems to be reached at an age of two years. The largest mullet recorded is a female of  $19\frac{1}{2}$  inches although they probably often attain a slightly greater size.

The growth of *Mugil* in Sandy Hook Bay may be indicated by the following table listing the average sizes of young fish at various collecting dates:

<i>Date</i>	<i>Average Standard Length</i>
July 12, 1923	26 mm.
" 25, "	34 "
August 2, "	34 "
" 9, "	42 "
" 16, "	52 "
" 23, "	54 "
" 30, "	54 "
October 9, "	80 "

**SIZE:** Reaches a length of 1 to 2 feet, 13 inches the largest individual recorded locally (*Woods Hole*).



### 92. White Mullet

*Mugil curema* Cuvier and Valenciennes

Soft dorsal and anal fins scaled. Sides uniform silvery.

**DISTRIBUTION:** Common summer visitant, June 4 to December 13, mostly schools of young from August through October. *Woods Hole*, common June 28 ( $1\frac{1}{4}$  inches in length) to October. *Orient*, June 4 to December 13, large schools of young sometimes present in late September and through October. *New York*, common, August to November 9. In 1925 more common in Sandy Hook Bay than *M. cephalus* which was generally somewhat larger.

Occurs from Cape Cod to Brazil, common.

**LIFE HISTORY:** Schools of young of uniform size are frequent in the shallow borders of salt and brackish bays off the south shore of Long Island in late summer. A number of individuals 10 to 13 cm. total length picked up stranded at Long Beach September 30, apparently from a school trapped by the vagaries of the surf, perhaps on southward migration.

It is not known how far north the breeding range of this species extends as mature fish north of Florida are decidedly rare although the young are common enough all along our coast. The spawning season is at its height in May and June.

**SIZE:** Adults are about 1 foot in length.

## BARRACUDAS.

Pike-shaped, surface fishes with long jaws set with irregular, formidable pointed teeth. Caudal fin forked, and a small first dorsal fin of a few slender spines well in advance of the longer second dorsal, as in the silversides and mullets.



### 93. Great Barracuda

*Sphyaena barracuda* (Shaw)

Scales large, 75 to 85. Teeth very large. Some irregular inky black spots on the flanks.

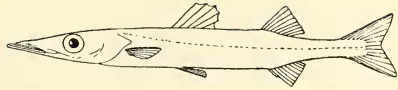
**DISTRIBUTION:** Casual to the eastward. *Woods Hole*, a rare straggler, the last recorded being in September 1897.

Occurs in the West Indian fauna, regularly north to South Carolina.

**SIZE:** There is an official record of a Barracuda 5 feet 3 inches total length, weight 54 pounds taken with rod and reel in Florida, and unauthenticated reports of its reaching a length of over 10 feet.



94. **Northern Barracuda**  
*Sphyræna borealis* DeKay<sup>2</sup>



Scales small, 115 to 130. Pectorals not reaching front of spinous dorsal. Maxillary not reaching front of orbit.

**DISTRIBUTION:** Summer visitant, in regular numbers, young rather common, adults less so. June 20 to December. *Woods Hole*, July to December, most common after October 1, young common, adults rare. *Orient*, variously common or uncommon. June 20 to November 12. *New York*, uncommon, June 20 to November 16.

Occurs on the Atlantic coast of the United States from Cape Cod to Cape Fear.

**FOOD:** Small fish, also young gastropods.

**LIFE HISTORY:** A young one,  $2\frac{3}{8}$  inches in total length, Sandy Hook, July 8, shows several interesting 'larval' characters. Lower jaw much projecting, its tip ending in a black fleshy flap; scales of posterior part of lateral line large, keeled, forming a caranx-like keel on peduncular region. Color when fresh somewhat translucent or silvery with dark blotches or bars. In alcohol dark saddles on the back, dark blotches along mid-line of side continuous in a dark band posteriorly, two or three large dark blotches on mid-line below, the first covering the front of the base of the anal.

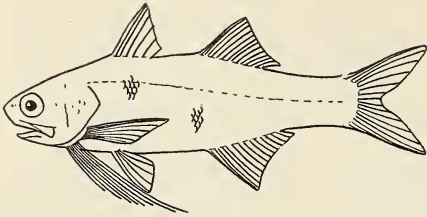
Keeled peduncular scales, present as a larval character in this species are particularly interesting on account of their being a striking permanent character of the whole group of unrelated Carangin fishes. The characters of larval fishes present an interesting field for investigation and discussion, with a bearing on our understanding of the evolution of this diversified group of animals. As a fish grows it frequently passes (just by reason of its changing size) from one ecological niche to another, and must be adapted to each, independently, with little or no support from the preceding generation; young fishes are frequently more specialized than their elders and there is a tendency for such specialized larvae to become permanent. The general rule that ontogeny tends to recapitulate phylogeny is sometimes badly upset.

**SIZE:** Reaches 12 inches, rarely more.

#### THREADFINS

Rather small fishes with two well separated dorsal fins of approximately the same size; the first of spines, the second of soft rays. Eye large, near the end of the projecting, pig-like snout. Mouth large. Several threadlike filaments arising from just in front of the base of the pectoral fins. Caudal fin forked. Scales rather small.

<sup>2</sup> *Sphyræna guachancho* of the West Indies, north to Florida, has been recorded from Woods Hole 1876, Buzzards Bay, 1883, the records open to question due to chance of confusion with *borealis*. It has scales 120 to 130, pectoral reaching front of spinous dorsal, maxillary reaching front of orbit.

95. **Eight-fingered Threadfin***Polynemus octonemus* Girard

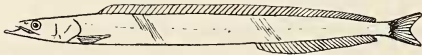
**DISTRIBUTION:** Casual, July 23 to October 28. *Woods Hole*, two records, September 1882, October 28, 1908. *Orient*, one record. July 23, 1917. *New York*, August 15 (1924, Sandy Hook Bay,  $6\frac{3}{4}$  inches standard length) to September.

Occurs on sandy shores of the south Atlantic and Gulf states, scarce.

**SIZE:** Reaches 10 inches total length (*Orient*).

**SAND EELS**

Elongate, compressed, silvery fishes with pointed head, projecting lower jaw, and forked caudal fin. A single low fin of slender spines or unbranched rays extends almost the entire length of the body.

96. **Sand Launce***Ammodytes americanus* DeKay

**DISTRIBUTION:** Permanent resident, abundant in late fall and early spring to the east and through the winter to the west. *Woods Hole*, abundant, taken throughout the year, most numerous in late fall and early spring, rare in winter. *Orient*, resident, often abundant in fall; uncommon in winter and warmer parts of summer; dug from soft-shell clam flats in winter. *New York*, permanent resident, abundant in colder months, uncommon in summer.

Occurs abundantly on sandy shores from Labrador and Newfoundland to Cape Hatteras.

An important food for the mackerel and other fishes; eaten by the bluefish in summer; porpoises and even finback whales at times feed on them.

The sand launce is abundant in the wash of sandy ocean shores, especially during the colder months of the year, diving in and out of the loose sand bottom with great agility. At times quantities of sand eels (perhaps driven by enemies such as the silver hake) are washed ashore and lie strewn along the water's edge, a rich harvest for the gulls. It is occasionally trapped by its habit of burrowing in the sand. I have found the head of one which was still alive projecting from a sand flat exposed by the falling tide.

Probably perfect adaptation to burrowing in the sand, removed this form from the influences of general competition with other fishes and consequent evolutionary change, at some point in past time, so completely

that it is now impossible to say to what manner of fishes it is most closely related.

**FOOD:** It is omnivorous feeding on all sorts of small marine animals, but predominantly on crustaceans.

**LIFE HISTORY:** The spawning habits of this species are doubtless similar to those of the closely related European launce which deposits its eggs on sandy bottoms at a depth of about 10 fathoms in winter. The eggs are oval, less than a mm. in long diameter. Fry have been taken at Woods Hole in March.

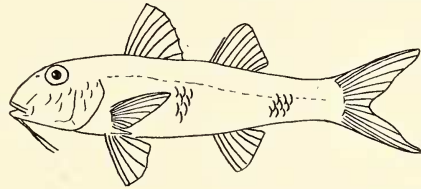
**SIZE:** Reaches a length of about 6 inches. Averages 4 inches standard length near New York in May. An overgrown specimen from Frenchmans Bay, Mt. Desert, Me., 7 inches in total length.

### GOAT FISHES<sup>3</sup>

Rather small fishes with forked caudal fins, and a weak-spined first dorsal fin about as large as the second dorsal. Scales of moderate size. Mouth inferior (lower jaw the shorter). A long double barbel at the chin.

#### 97. Northern Goatfish

*Mullus auratus* Jordan and Gilbert



**DISTRIBUTION:** Uncommon and irregular in late summer and fall, July 25 to November 7. *Woods Hole*, usually rare, a few in September, irregularly more numerous, July 25 to September 20. *Orient*, uncommon September 9 to November 7. *New York*, occasionally common September and October.

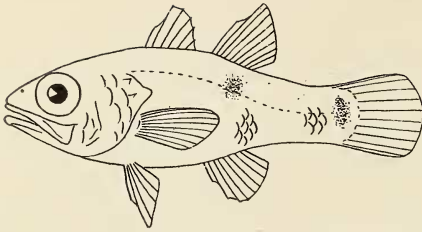
Occurs from Cape Cod to Florida.

**SIZE:** Reaches a length of 8 inches, local specimens usually 4 inches or less, the largest 6½ inches total.

### CARDINAL FISHES

Small, symmetrical, chunky fishes, with large mouth, large eye, and rather large scales. A first dorsal of weak spines separate from and not differing greatly in size from a second dorsal of soft rays. Anal spines 2 (rarely 3).

<sup>3</sup>The young of some species of squirrel fish, of which there are several in the West Indian fauna, are reported as accidental at Woods Hole. They are large eyed, spiny finned, coarse scaled fishes, more or less red in color, with more than 5 soft rays in each ventral fin, and the middle of 3 anal spines very stout.

98. **Spotted Cardinal Fish***Apogon maculatus* (Poey)<sup>4</sup>

Base of caudal without blackish blotch; a black blotch below soft dorsal, on peduncle, and on opercle.

**DISTRIBUTION:** Casual in the Woods Hole region. Eleven specimens September 1 to 16, 1899.

Occurs in the West Indian fauna, from West Florida to Brazil.

**SIZE:** Reaches a length of about 4 or 5 inches.

## SEA BASSES

Symmetrical, rather large-mouthed fishes with a spiny anterior and soft-rayed posterior portion to the dorsal fin, the two usually, not always, connected at the base. Eye moderate in position and size. Pseudobranchiae well developed. Ventral fins without a scaly flap at their base. Upper corner of operculum with one or two more or less obscure flattened spines. The fins not densely scaled, lateral line not extended across the caudal. Ventral fins usually inserted slightly behind the pectorals, their rays regularly 15. Scales moderate or small, more or less rough. Teeth pointed, in bands, some of them generally hinged. Caudal rounded, squarish, or weakly forked.

- |    |   |  |
|----|---|--|
| a. | Anal spines wanting.<br>Anal spines 3, well developed, (see b).   | <i>Rypticus</i>                          |
| b. | Two dorsal fins (see c).<br>One dorsal fin, spinous portion sometimes separated from soft-rayed by a deep notch (see d).  |  |
| c. | Dorsal fins entirely separate; anal soft rays 12.<br>Dorsal fins barely joined at base; anal soft rays 9.   | <i>Roccus</i><br><i>Morone</i>           |
| d. | Head armed with rough spiniferous crests. Spines of anal and ventrals somewhat serrate on the anterior edge.<br>Not as above; ventrals anterior to pectorals; scales 55 to 60.<br>As above, but ventrals below or behind pectorals; scales 90 to 140 (see e). | <i>Polyprion</i><br><i>Centropristes</i> |

<sup>4</sup> There is a record of the Mediterranean Cardinal Fish, *Apogon imberbus* from Newport, which is questionable, due to chance of confusion with this or some other American form.

c. Anal with 11 or 12 soft rays.

Anal with 7 to 9 soft rays, head very broad above.

Anal with 7 to 9 soft rays, head rather narrow above.

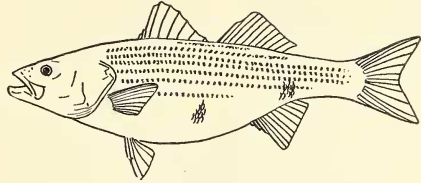
*Mycteroperca*

*Garrupa*<sup>5</sup>

*Epinephelus*

### 99. Striped Bass

*Roccus lineatus* (Bloch)



**DISTRIBUTION:** Fairly common, permanent resident at least to the westward, most numerous in fall. *Woods Hole*, less common than formerly, May 1 to November 1, most frequent in June. *Orient*, resident, rare in summer and usually so in winter; irregularly common fall, October 1 to December. *New York*, fairly common, permanent resident, most common in fall.

Occurs on the Atlantic coast from the Gulf of St. Lawrence to Florida, most common from Cape Cod to Cape May. Introduced successfully on the Pacific coast. Found in both fresh and salt water.

The striped bass is caught from our ocean shores and also ascends the Hudson River abundantly. It is the finest food fish taken locally. Before the weakfish arrive, rod and line anglers from New York City often take their boats up the Hudson River in pursuit of striped bass. After the weakfish have gone, striped bass are again in season. They are now often fished for off the beach by casting through the surf. This is the type of fishing hereabouts in which the catch of fish is of least importance. Just an occasional bass to lend a touch of sanity to the performance will keep a whole row of anglers on the beach vying with one another in the skill and distance with which they can cast through the surf. Most of the bass now taken near New York are small, from two to six or seven pounds in weight. It takes special skill to hook and land the bigger ones, unless by luck.

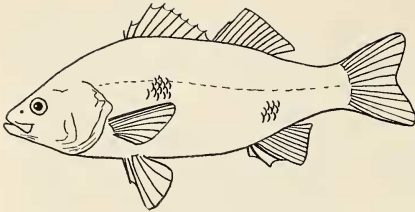
**FOOD:** Eats fish and large crustacea, as crabs and lobsters.

**LIFE HISTORY:** To the south of our territory this species spawns in May. The eggs are non-adhesive, and average about  $3\frac{1}{2}$  mm. in diameter. They are very slightly heavier than water, so probably are constantly drifting about during incubation. At a temperature of 58° Fahr. they hatch in about three days. The maximum number recorded is 2,200,000, although a large female probably will exceed this number greatly. This species ascends rivers for the purpose of spawning or may spawn in bays. New York Bay was formerly an important spawning ground.

**SIZE:** Often reaches 30 to 90 pounds, 125 pounds, the maximum.

<sup>5</sup> Young of the black jew fish, *Garrupa nigrita* are reported casual at Woods Hole, but this is a very large fish, over 100 pounds, its young comparatively little known, and the identification of these specimens is open to question.





100. **White Perch**  
*Morone americana* (Gmelin)

Deeper-bodied than the striped bass, depth  $2\frac{2}{3}$  times in length to base of tail fin; mouth smaller, tail fin only slightly forked. Color uniform silvery or whitish on the sides, more or less olivaceous on the back. Somewhat similar to *Bairdiella* but with 3 anal spines.

**DISTRIBUTION:** Common permanent resident. Occurs along shore in undiluted sea water from fall till early spring. *Woods Hole*, abundant permanent resident. *Orient*, locally common resident, more generally common in fall and winter. *New York*, common permanent resident.

Occurs on the Atlantic coast from Nova Scotia to South Carolina. A fresh and salt water species.

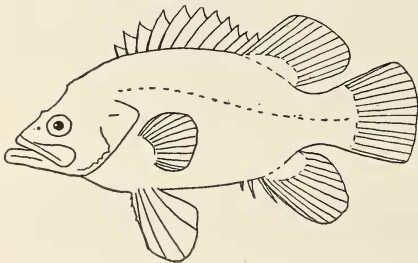
Found in shallow water, bays creeks or ponds, where it wanders in small schools, and congregates in the deeper parts to spend the colder months in a more or less sluggish condition.

The well known white perch is a close relative of the striped bass and agrees with it in essentials of structure. It is characteristic of coastwise ponds but also found in brackish or even salt water. This is a fish about the size of a yellow perch or a trifle larger, and as a table fish superior to that species. It may readily be told from the yellow perch by the absence of black bars on the sides and the form. The white perch is one of the most universally popular panfish throughout the Atlantic seaboard.

**FOOD:** Fish, shrimps and other crustacea.

**LIFE HISTORY:** Spawns in fresh and brackish ponds in May and June. (*Woods Hole*). This species spawns in April and May in fresh or brackish water (*New York*). The eggs, about  $\frac{3}{4}$  mm. in diameter sink and stick together in masses or to any object on which they rest; and average about 40,000 to the female. At a temperature of 58° Fahr. they hatch in about three days. In many ways the spawning of this form is similar to that of *Roccus*.

**SIZE:** The maximum size is about 15 inches long, 2 or 3 pounds in weight.



101. **Wreckfish**  
*Polyprion americanus* (Bloch and  
Schneider)

**DISTRIBUTION:** Accidental in August, one record, New York, a young fish.

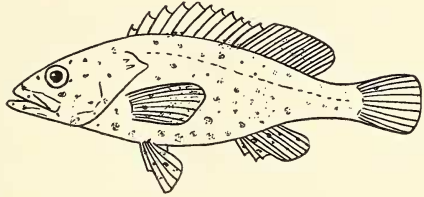
Occurs off the coast of Europe.

The adults are not uncommon in deep water of 300 fathoms or more, said to live mostly about wrecks. The young swim near the surface, especially southward.

**SIZE:** Reaches 5 or 6 feet in length.

### 102. Rock Hind

*Epinephelus adscensionis* (Osbeck)



Second dorsal spine short, lower than third or fourth. Maxillary without scales; body and bases of fins covered with small red or orange spots, darker than the ground color, which turn dusky in preservative. Caudal somewhat rounded.

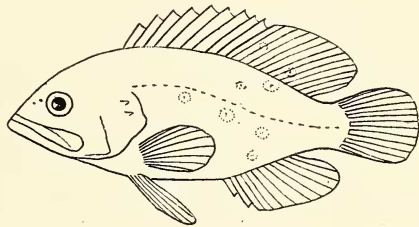
**DISTRIBUTION:** Accidental. One young specimen, Katama Bay, September 19, 1899.

Occurs in the South Atlantic Ocean, and the West Indian fauna of the North Atlantic from Florida Keys to Brazil.

**SIZE:** Reaches a length of about 16 inches.

### 103. Snowy Grouper

*Epinephelus niveatus* (Cuvier and Valenciennes)

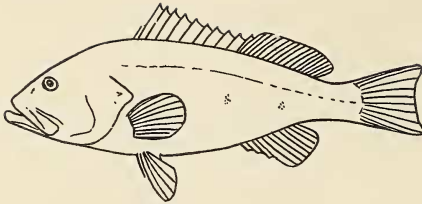


Second dorsal spine short, lower than third or fourth. Maxillary more or less scaled. Body marked with large spots, steel blue in life, paler than the ground color.

**DISTRIBUTION:** Not rare in the Woods Hole region, August to November, unknown elsewhere in our region.

Occurs in the West Indies and to Brazil, occasionally northward in the Gulf Stream, not common.

**SIZE:** Reaches a length of about 2 feet.



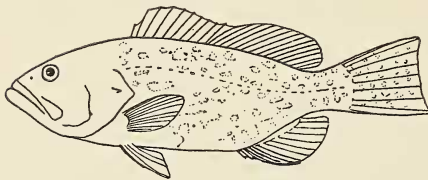
104. **Red Grouper**  
*Epinephelus morio* (Cuvier and  
Valenciennes)

Second dorsal spine elevated, not lower than third or fourth. Color brownish or reddish, more or less variegated. The bases of the jaws always reddish.

**DISTRIBUTION:** Young casual to the eastward, September 1 to 26. *Woods Hole*, casual, September 1 to 26.

Occurs on the Atlantic coast of America from Virginia to Rio Janeiro.

**SIZE:** Reaches length of 1 to 3 feet.



105. **Black Rockfish**<sup>6</sup>  
*Mycteroperca bonaci* (Poey)

Angle of preopercle not salient; ten gill-rakers, besides rudiments on the lower limb of the arch; scales about 110.

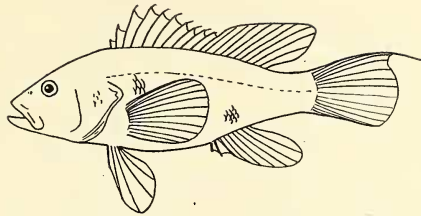
**DISTRIBUTION:** Casual to the eastward. *Woods Hole*, several records, August, September and October.

Occurs in the West Indian fauna from Florida to Brazil, abundant about the Florida Keys and Cuba.

The typical marine sea-basses, one of the dominant groups of modern fishes, fall naturally into two rather ill defined series, the temperate and the tropical. The former has many Mediterranean species, and is well developed in California waters, but our common sea bass, *Centropristes*, is almost its only representative here, where due to the influence of the Gulf Stream, groupers and rockfish, representative of the tropical series are a possibility as stragglers summer and fall, and in winter the ocean is boreal in character.

**SIZE:** Reaches 2 or 3 feet in length.

<sup>6</sup> The Cuban rockfish, *Mycteroperca interstitialis*, is recorded at *Woods Hole*, but in view of its close resemblance to this and other more probable species, the identification is doubtful.

**106. Sea Bass***Centropristes striatus* (Linnaeus)

**DISTRIBUTION:** Common, spring, summer and fall, April to December 7. *Woods Hole*, common, May 10 to October. Most abundant from July to September. *Orient*, April 30 (1913) to October 18 (adult) and December 7 (young). *New York*, common, April to December. An apparently somewhat shorter season to the east may indicate east-west migration along the coast.

Occurs from Cape Ann (rarely Maine) to northern Florida, common between Cape Cod and Cape Hatteras. Adults occur in rather deep water, minimum a couple of fathoms, close to rocky bottom.

The sea bass which is one of our best and commonest local food-fishes, is most plentiful on fishing banks a little off-shore, and the young which have a dark, lengthwise stripe abound in coastwise bays in autumn.

The hardness of its flesh makes it desirable for packing in ice, and prevents rapid deterioration in hot weather. It is an excellent chowder-fish and delicious boiled or broiled. It is the species most sought in summer by the steamers which regularly take fishermen from New York to the outside banks of the Long Island and New Jersey shores.

**FOOD:** Fish, squid, and crabs.

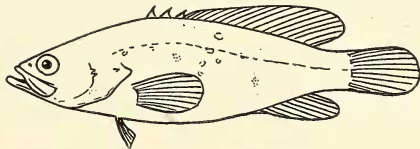
**LIFE HISTORY:** Spawns from middle of May to first of July (*Woods Hole*.)

Sea bass spawn during the month of June. The eggs are buoyant, non-adhesive, and average about 1 mm. in diameter. At a temperature of 50° Fahr. they hatch in about five days.

Small examples of 20 mm. in standard length may be taken from the oyster beds about one-half mile off Staten Island during August.

In June in Sandy Hook Bay, sea bass very likely a year old averaged 175 mm. in standard length; on July 31 a ripe female of 8 $\frac{5}{8}$  inches (219 mm.) was taken. From September 6 to 19, 1922, examples taken in a dredge showed an average growth of from 25 to 40 mm. standard lengths.

**SIZE:** A 5-pound sea bass is an unusually large one, but there are records for almost twice that weight. Commonly reaches 18 inches length and 3 pounds weight. Largest at *Orient* 7 pounds. The record is 8 pounds 2 ounces, a fish caught off New York.

**107. Soapfish***Rypticus bistrispinus* (Mitchill)

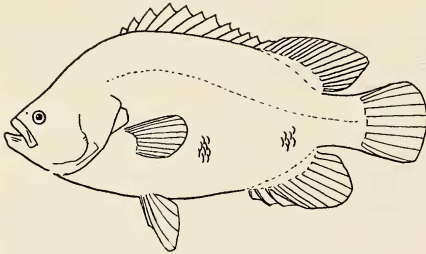
DISTRIBUTION: Accidental, one record, Newport.

Occurs in rather deep water from Charleston to Key West.

SIZE: About one foot in length.

### TRIPLE-TAILS

Large, bass-like fishes, with rather small, rough scales; deep compressed body: eye near front of the head; lower jaw projecting; preopercle serrate. The soft rayed dorsal and anal fins project backward in blunt points. The anterior spinous dorsal fin consists of stout spines and is connected with the base of the soft rayed fin behind it. Caudal fin rounded. Body outline concave over the eye.



#### 108. Triple-tail

*Lobotes surinamensis* (Bloch)

DISTRIBUTION: Rare in summer and fall, July 13 to December. *Woods Hole*, very rare, August 15 to December. *New York*, rare, July 13 to October.

Occurs generally distributed in warm seas, north to Cape Cod.

We know of few recorded instances of this species being met with in numbers on our Atlantic Coast. In late September, 1923 Dr. C. L. Summers found them numerous, weighing from 14 to 21 pounds, about an old wrecked steamer off Beaufort, N. C. They could be seen disporting vigorously in the surf washing over the wreck, and when hooked proved active and gamey.

SIZE: Reaches 3 feet in length.

### BIG-EYES

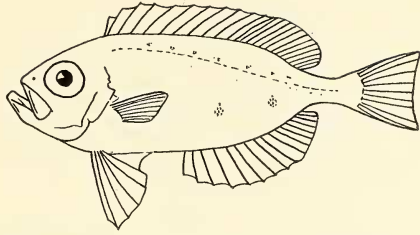
Large-eyed fishes differing from the sea basses in that the head as well as the body is everywhere covered with fine rough scales, and the anal fin is similar to and scarcely shorter than the dorsal.

Scales small, 80 to 100, depth of body less than half length. *Priacanthus*

Scales moderate, 35 to 50, depth of body more than half of length.

*Pseudopriacanthus*

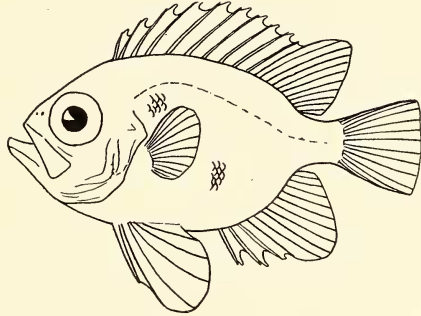


**109. Big-eye***Priacanthus arenatus* Cuvier and Valenciennes

**DISTRIBUTION:** Young rare in fall to the eastward, October 10 to November 7. *Woods Hole*, rare in fall, to November 2. *Orient*, rare in fall, October 10 to November 7.

Occurs in the tropical Atlantic, south to Brazil, young northward in the Gulf Stream to the coast of Massachusetts.

**SIZE:** Reaches a length of about one foot.

**110. Deep Big-eye***Pseudopriacanthus altus* (Gill)

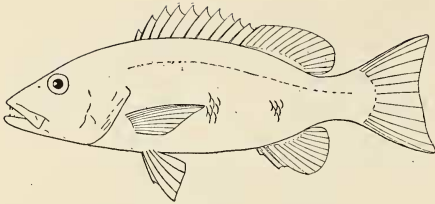
**DISTRIBUTION:** Rare in late summer and fall, August 20 to November 3. *Woods Hole*, usually rare, many taken in September 1899. *New York*, very rare, August 20 to November 3 (1922, Point O' Woods, Mrs. H. W. Smith).

Occurs in the West Indian fauna, north to Charleston, The young stray north in the Gulf Stream to Massachusetts, occasionally being washed ashore or trapped in puddles on the beach; they are very easily identified, flat, almost circular in outline, and bright red.

**SIZE:** Largest 11 inches long.

**SNAPPERS**

Small or medium sized, compressed, symmetrical fishes, with a single back fin composed of an anterior spiny and posterior soft rayed portion of about equal length, a scaly flap at the base of the ventral fins. Upper corner of operculum without spines. The maxillary moderately, not excessively, protractile. Teeth pointed, unequal, some of them large. Fins not scaly.

**111. Gray Snapper***Lutianus griseus* (Linnaeus)

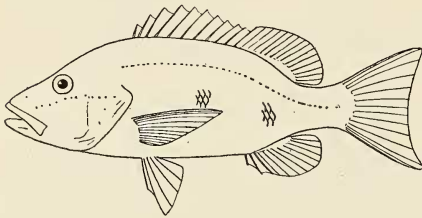
Anal fin more or less rounded. No black lateral spot. Comparatively elongate,—depth  $2\frac{3}{4}$  to 3 in standard length. Mouth large, maxillary  $2\frac{1}{2}$  in head.

**DISTRIBUTION:** Casual, *Woods Hole*, August, September and October.

Occurs in the West Indian fauna, New Jersey to Brazil.

This is the common shallow water snapper about the Florida Keys. Small schools of young ones prowl along the edges of the mangroves, and larger individuals frequent the deeper channels among the reefs. Wary, alert, strong, swift and adaptable, the gray snapper abounds where competition in fish life is keenest, an excellent example of the highest development in modern spiny-rayed fishes.

**SIZE:** Reaches a length of about 18 inches.

**112. Dog Snapper***Lutianus jocu* (Bloch and Schneider)

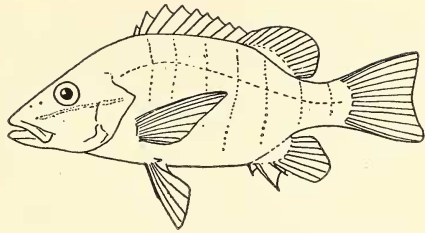
Anal fin more or less rounded. No black lateral spot. Depth about  $2\frac{1}{2}$  in standard length. Maxillary about 3 in head. Fins orange or yellow in life. Scales (counted above lateral line) about 55. A whitish area below eye.

**DISTRIBUTION:** Accidental, one record, a young fish. *Woods Hole*, September 21, 1897.

Occurs in West Indian fauna from the Florida Keys to Brazil.

The dog snapper is reputed to be unwholesome. All other species of this genus are excellent food fish.

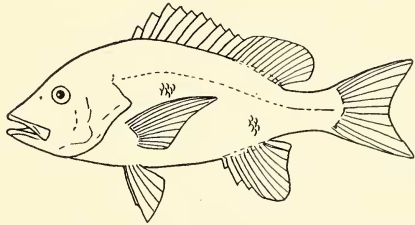
**SIZE:** Reaches a length of about 2 feet.

**113. Schoolmaster Snapper***Lutianus apodus* (Walbaum)

Resembles *L. jocu*, but scales larger (counted above lateral line) about 45; no whitish area below eye; etc.

**DISTRIBUTION:** Young casual at Woods Hole, August 29 to September 20. Occurs in the West Indian fauna from the Florida Keys to Brazil.

**SIZE:** Reaches a length of about 18 inches.

**114. Red Snapper***Lutianus aya* (Bloch)

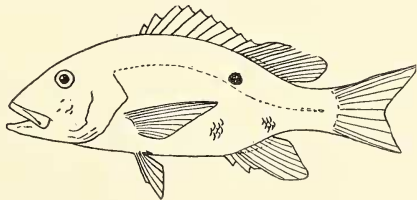
Anal fin angulated, its middle rays more or less produced. Maxillary reaching opposite front of pupil. Color rather uniform bright red in adult, young with a black spot on the side.

**DISTRIBUTION:** Young casual at Woods Hole, September to October 10. *New York*, accidental, October.

Occurs in the West Indian fauna from Florida to Brazil, straying north to Long Island. Favors rocky banks in rather deep water.

Perhaps the best food fish of all the snappers, and shipped extensively to northern markets. A fine large red snapper, baked, is unsurpassed as a table dish.

**SIZE:** Reaches a length of 2 to 2½ feet.

**115. Mutton Snapper***Lutianus analis* (Cuvier and Valenciennes)

Anal fin angulated, its middle rays more or less produced. Maxillary

reaching only to opposite front of eye. Colors olivaceous, rosy below, fins red. A small but distinct black spot on the side at all ages.

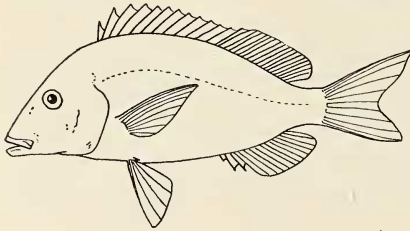
**DISTRIBUTION:** Rare at Woods Hole, August, September and October.

Occurs in the West Indian fauna from Florida to Brazil. A favorite southern food fish.

**SIZE:** Reaches a length of 27 inches, weighing 21 pounds.

### GRUNTS

Small, compressed, symmetrical fishes with a single back fin composed of an anterior spiny and posterior soft rayed portion of about equal length. A scaly flap at the base of the ventral fins. Upper corner of operculum without spines. The maxillary moderately, not excessively, protractile. Teeth small, pointed. Fins usually more or less scaly.



116. Pigfish

*Orthopristis chrysopterus* (Linnaeus)

A lengthwise pit or groove on the chin. Mouth not large, the maxillary  $3\frac{1}{3}$  in the head. Dorsal with 16, anal 12 or 13 soft rays. Color bluish, with small bronze spots.

**DISTRIBUTION:** Rare in late summer and fall, occasionally common to the westward, June 29 to November 17. *Woods Hole*, one record, October 21, 1908,  $8\frac{1}{4}$  inches long. *Orient*, rare, June 29. *New York*, occasionally common, August to November 17.

Occurs on south Atlantic and Gulf coasts of the United States from Long Island to the Rio Grande.

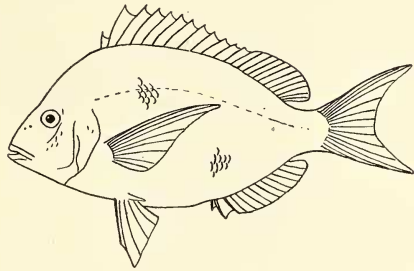
This species apparently enters our region following the coast from the southwest, in contrast with various others which apparently drift north as young in the Gulf Stream. Large as well as small specimens occur, and it is more frequent to the westward than to the eastward.

**SIZE:** Reaches 12 to 15 inches; a local specimen of  $9\frac{1}{2}$  inches total length.

### PORGIES

Small compressed, symmetrical fishes with a single back fin composed of an anterior spiny and posterior soft rayed portion of about equal length; a scaly flap at the base of the ventral fins. Upper corner of operculum without spines. The maxillary moderately, not excessively, protractile. Teeth in the back of the mouth flat, molar-like. Anterior teeth more or less incisor-like, sometimes compressed. Fins not scaly.

- a. Second interhaemal spine (above the anal fin) 'pen shaped,' hollowed. *Stenesthes*  
 Second interhaemal spine normal, not as above, (see b).
- b. Incisor teeth in front of jaws conspicuously notched. *Lagodon*  
 Incisors entire or with a shallow notch. *Archosargus*

117. **Porgy***Stenesthes chrysops* (Linnaeus)

**DISTRIBUTION:** Abundant in summer and fall, April 16 to December 4. *Woods Hole*, abundant, May 1 to the latter part of October, most abundant in June and July. *Orient*, abundant, April 16 (1913) and April 18 (1908) to December 4. *New York*, abundant, April to November.

Occurs from Cape Ann (casually Maine) to South Carolina, probably moving off into deeper water with the approach of winter. Occurs mostly in bays and coastwise, taken down to 17 fathoms (*Woods Hole*).

**FOODS:** Small crustacea, worms, mollusks, fish, squid, etc., and also vegetable debris.

Porgies usually congregate in schools, and feed at or near the bottom, sand or mud preferred.

**LIFE HISTORY:** Spawns early in June (*Woods Hole*); males with running milt June 1 to 23 (*Sandy Hook Bay*). Young from 1 to 3 inches in total length sometimes very abundant October 10 to December 1, at which dates the adults have fallen off in number.

Porgies spawn in June and July. The eggs are buoyant, transparent and spherical, varying from 0.85 to 0.90 mm. in diameter. A single oil globule is normally present in the yolk. At a temperature of 72° F. they hatch in about 40 hours after extrusion. On hatching the larvae measure about 2.8 mm. At 25 mm. most of the diagnostic characters have been developed but still there is comparatively little resemblance to the adult, chiefly on account of the much slimmer body of the young.

Measurements and the examination of the scales of specimens from *Sandy Hook Bay* indicate growth as set forth in the following table which gives what are apparently the normal sizes of fish up to the age of three years.

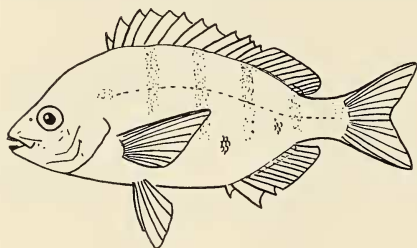
<i>Average Standard Length</i>			
<i>1st Winter</i>	<i>2nd winter</i>	<i>3rd winter</i>	<i>4th winter</i>
70 mm.	112 mm.	117 mm.	180 mm.



In September most of the fish average about 180, while there is a smaller group of about 68, which show as 70 in the above table.

Spawning probably takes place for the first time in the third summer.

SIZE: A specimen from Orient had a total length of  $16\frac{1}{4}$  inches, weight 2 pounds. Said occasionally to reach a weight of 3 or 4 pounds.



### 118. Pinfish

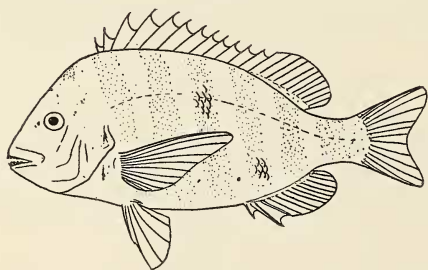
*Lagodon rhomboides* (Linnaeus)

DISTRIBUTION: Usually rare, sometimes common to the eastward, summer and fall, June to October 25, (November 18). *Woods Hole*, usually rare, sometimes common June to October 25. *Orient*, rare, August 2 to November 18, occurs each fall. *New York*, occasional, summer and autumn.

Occurs on the Atlantic and Gulf coasts of the United States from Cape Cod to Cuba, abundant from some point south of New York to Pensacola. Occasionally adults are taken in Sandy Hook Bay. Young are more frequently common in the fall, although exceptionally scarce in 1923 and 1924.

Date	Average Standard Length
August 31	45 mm.
October 19	65 "

SIZE: A very large specimen taken in Buzzards Bay measured  $10\frac{1}{2}$  inches.



### 119. Sheepshead

*Archosargus probatocephalus*  
(Walbaum)

DISTRIBUTION: Rather common formerly in summer, now rare, June to October. *Woods Hole*, July and August. *Orient*, formerly irregularly common, now unknown, last record August 19, 1904. *New York*, June to October.

Occurs from Cape Cod to the Florida Keys and Texas, common southward. Casual in the Bay of Fundy.

**LIFE HISTORY:** In Florida this species spawns during March, whilst it spawns later in more northern parts of its range. The eggs measure about 0.8 mm. in diameter and are non-adhesive and buoyant. They hatch in about 40 hours at a temperature of 77° F.

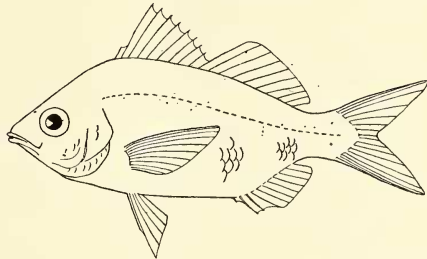
**SIZE:** Reaches a length of about 30 inches, and weight of 20 pounds.

### GERRIDS

Small porgy-like fishes with the upper jaw excessively protractile, capable of being thrust far forward. Outline of the lower jaw concave.

#### 120. Common Mojarra

*Eucinostomus gula* (Cuvier and Valenciennes)



**DISTRIBUTION:** Rare in irregular numbers in late summer and fall, mostly to the eastward, August to October. *Woods Hole*, rare in irregular numbers, August to October. *New York*, accidental, August.

Occurs from Carolina to Brazil, the young ranging northward to Woods Hole.

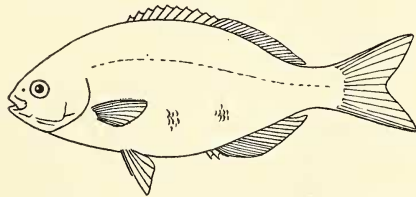
**SIZE:** Reaches a length of 4 to 5 inches.

### KYPHOSIDS

Deep-bodied, compressed, porgy-like fishes, with small incisor teeth, each tooth with a conspicuous horizontal process or root.

#### 121. Bermuda Chub

*Kyphosus sectatrix* (Linnaeus)<sup>7</sup>



Dorsal with 14, anal with 12 soft rays, scales about 85.

**DISTRIBUTION:** Rare in summer and fall, more numerous to the eastward, April, September to November 2. *Woods Hole*, not rare in summer and fall (October 15) mostly about 6 inches long, occasionally met with in April.

<sup>7</sup>The yellow chub, *Kyphosus incisor*, has been reported once from Nantucket. Its range is Cuba, Brazil, etc., and the identification is open to question. The scale-count of this species is about 65.

*Orient*, two records, June 3; and November 2, 1915. *New York*, rare, September and October.

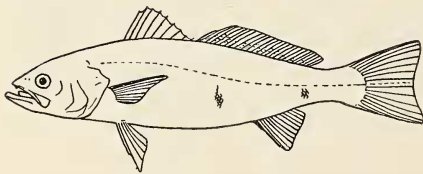
Occurs from Cape Cod to the West Indies and Canary Islands. Sometimes found among gulf weed at surface. (Woods Hole.)

SIZE: Reaches 18 inches.

### CROAKERS

Symmetrical fishes resembling the sea basses, with scaly caudal fin, the lateral line extended across it. The spiny and soft-rayed dorsal united at the base. Anal fin short; soft dorsal long.

- |    |   |                     |
|----|---|---------------------|
| a. | Lower jaw projecting, caudal fin emarginate.  | <i>Cynoscion</i>    |
|    | Not as above, the lower jaw more often included, central caudal rays more often longest (see b).  |                     |
| b. | Lower jaw without barbels, (see c).   |                     |
|    | Lower jaw with one or more barbels (see f).   |                     |
| c. | Teeth of lower jaw, which is slightly included, wanting or deciduous. Caudal fine emarginate.   | <i>Leiostomus</i>   |
|    | Teeth well developed, permanent in both jaws (see d).   |                     |
| d. | Gill-rakers short and thick, usually not longer than posterior nostril. Lower jaw included. A large fish with a squarish caudal and black spot at its base above. | <i>Sciaenops</i>    |
|    | Gill-rakers comparatively long and slender. Lower jaw slightly projecting (see e).  |                     |
| e. | Mouth very oblique. Preopercle without bony serrae.   | <i>Larimus</i>      |
|    | Mouth not very oblique. Preopercle with bony serrae.  | <i>Bairdiella</i>   |
| f. | Lower jaw with several slender barbels. Preopercle with bony serrae.  | <i>Micropogon</i>   |
|    | Lower jaw with several slender barbels. Preopercle nearly entire.   | <i>Pogonias</i>     |
|    | Lower jaw with a single thickish barbel at its tip, snout piglike projecting beyond the mouth.  | <i>Menticirrhus</i> |



#### 122. Weakfish

*Cynoscion regalis* (Bloch and Schneider)

Soft rays of dorsal and anal scaled; gill rakers 9 to 12 on the lower part of the first arch. Upper parts freckled with irregular, ill defined brownish spots.

DISTRIBUTION: Abundant in summer and fall, April 20 and 25 at *Orient*, May 4 at *New York* to December 8; adults rare or absent after October 15 (Woods Hole), October 30 (*Orient*) and early November (*New York*). *Woods Hole*, abundant, (April 1898) May to mid-October. *Orient*, April

20 and 25 (average arrival May 7) to December 8 (young only after October 30). *New York*, common May 4 to November (December 6, adult).

Occurs on the Atlantic and Gulf coasts of the United States from Massachusetts Bay to Mobile.

While with us the weakfish prefers sandy shores and water of no great depth, swimming either near the surface or near the bottom, often in large schools. It is the principal salt-water game fish pursued with rod and line by dwellers of New York City. Stragglings weakfish usually reach our waters in May, but the middle of June has generally arrived before they appear in abundance, the time of their appearance being dependent upon whether the season is an early or a late one, and the corresponding temperature of the water. For days before the weakfish come some of the most enthusiastic fishermen have been going out diligently to find them, and the first schools are welcomed with enthusiasm by the angling fraternity who at once take to boats in their pursuit.

The baits most in favor for weakfishing are white worms and shedder crab. Sometimes the white worm bait is topped with a live shrimp impaled on the very tip of the hook, and shrimps are frequently used as "chum" to lure the fish about the boat.

When large weakfish become very abundant off the ocean beaches, as they frequently do, sailboats (now mostly replaced by power boats) cease trolling for bluefish, lie in the wind, and fish for the "weaks" with metal bluefish "squid," in a manner known as "jigging." The "squid" is lowered to near the bottom, and at intervals lifted rapidly through a foot or two of water and allowed to drop back again.

**FOOD:** Fish (menhaden, butterfish, and many other species), squid, shrimp, occasionally amphipods. Weakfish of 13 to 20 inches commonly take menhaden 4 or 5 inches long, three such fish may be found in a weakfish's stomach. Young weakfish 6 inches in length have been taken from stomach of adults weighing 3 and 4 pounds (Orient).

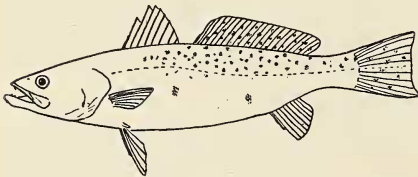
**LIFE HISTORY:** The weakfish spawns throughout our region in the larger bays and possibly in the open sea as well. The season extends from early May to September, and the greatest amount of spawn is deposited before July. The spawning occurs near the bottom, generally in from 3 to 5 fathoms of water, and probably usually at night. The fertilized eggs rise to the surface at once where they drift about in the currents. Fertile weakfish eggs have been taken in tow-nets at temperatures ranging from 60 to 70° F. They are spherical and almost colorless and are somewhat adhesive when first extruded. This latter character they soon lose. The eggs from different females vary considerably in diameter, ranging from 0.74 to 1.10 mm. The smaller sizes predominate. From one to four oil globules are present in the yolk. As development advances they coalesce into one and the specific gravity of the eggs becomes greater, causing them to sink before hatching. At a temperature of from 68° to 70° F., they hatch in from 36 to 40 hours. The newly hatched larvae are about 1.75 mm. in length and possess a large yolk sac. At about 24 hours after hatching their

length is 2.2 mm., the yolk sac is much reduced and the pectoral fins are distinct. In specimens of 12.5 mm. the fins are fully differentiated and the larval fin fold is gone. The growth of the young weakfish is rapid during the summer but practically ceases with the coming of winter. Fish hatched on June 1 average as follows for the next five months: July 1, 30 mm.; August 1, 80 mm.; September 1, 130 mm.; October 1, 170 mm.; November 1, 180 mm. On account of the extended spawning season and the consequent great overlapping of the year classes and the wide variation in size the first winter, it is extremely difficult to follow the growth satisfactorily. However, the following averages are offered, being based on scale examination. First winter—100 to 130 mm., second winter—210 mm., third winter—280 mm., fourth winter 330—mm., fifth winter—360 mm. (14 inches). The first spawning occurs at an age of three or four years for the females while the males mature a year earlier (2 or 3 years). Spawning occurs annually thereafter.

Young weakfish between 1 and 2 inches in length have a conspicuously projecting lower jaw like the adult, but a pointed, graduated caudal fin.

SIZE: Inshore, school weakfish do not average over a pound in weight. Offshore, they run larger, 5 or 6 pounds being common, and 10 pounds not rare. Thirty pounds have been reached by the species.

In Sandy Hook Bay the majority of adult weakfish average about 14 inches in standard length, and generally range from 8½ to 17 inches. Fish of over 20 inches are exceptional in that bay. Young fish of about one year, measuring 4 to 5⅛ inches are sometimes taken, but as a rule are not common.



### 123. Southern Weakfish

*Cynoscion nebulosus* (Cuvier and Valenciennes)

Soft rays of dorsal and anal scaleless; 6 to 8 gill rakers on the lower part of the arch. Back posteriorly with round black spots, similar somewhat smaller spots on dorsal and caudal fins. *Sandy Hook Bay*, July 9, 1926, 14 inches standard length.

DISTRIBUTION: Casual, three records at Orient; June 3 to June 15; Gardiners Bay, about 1½ pounds each.

Occurs from New York to Texas, common southward.

LIFE HISTORY: The development of the southern weakfish, which is rare north of Delaware Bay, is not so well known as that of its congener *C. regalis*. The eggs and larvae are unknown, the smallest post larvae recorded already having a length of 28 mm. Scale examination shows the growth to be somewhat as follows: first winter, about 115 mm., second

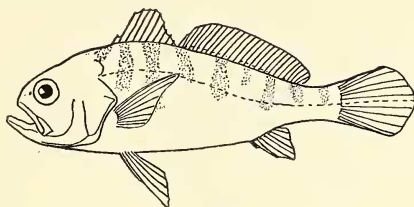


winter, 230, third winter, 310, fourth winter, 360, fifth winter 400, and sixth winter 430.

SIZE: Reaches a weight of about 7 pounds.

#### 124. Banded Croaker

*Larimus fasciatus* Holbrook



DISTRIBUTION: Accidental, at least 3 times, July to August 13. *Woods Hole*, once, August 13, 1889. *New York*, accidental, July and August.

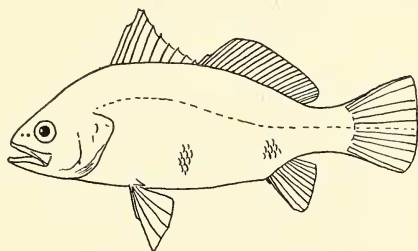
Occurs from Chesapeake Bay to Galveston, Texas.

LIFE HISTORY: The life history of this small straggler to our shores is very poorly understood. Young fish of 40 mm. in length closely resemble the adult in coloration and form. The average size attained by this species is in the neighborhood of 110 mm., and individuals of more than 200 mm. (8 inches) are uncommon.

SIZE: Reaches a length of about 10 inches.

#### 125. Silver Perch

*Bairdiella chrysura* (Lacépède)



Somewhat similar in appearance to *Morone* but has only 2 anal spines.

DISTRIBUTION: Sometimes common to the westward in summer and fall; not recorded east of Long Island; May 23 to December 18. *Orient*, casual, May 23, a fish 6 inches total length, and November 15, one of 9 inches. *New York*, sometimes common, June 28 to December 18.

Occurs on sandy shores from western Long Island to Texas.

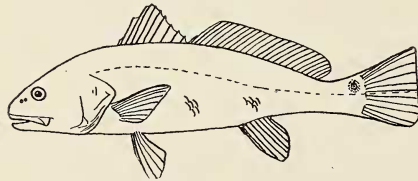
This is another southern summer species, which from its greater abundance to the west unquestionably reaches our region, when it does so, by a coastwise migration or extension. It is in contrast with various southern stragglers which occur most frequently with us about Woods Hole, and the reason is not far to seek. Its young as well as the grown fish live in inshore waters and are not subject to dispersal by ocean drifting.

LIFE HISTORY: The northward extension of the range of the silver perch stops at New York, but nevertheless it is abundant on the New Jersey

coast, where the height of its spawning season is in May. The eggs are spherical, transparent, slightly yellowish in color and buoyant. They range in diameter from 0.7 to 0.8 mm., and contain a single large colorless oil globule. The eggs of the silver perch hatch in from 40 to 45 hours at a temperature of from 66 to 70° F. The fry on hatching average about 1.7 mm. in length. It takes them about two days to absorb the yolk. At a length of 30 mm. the young resemble the adults in all essential respects. By the first winter first hatched in May are about 120 mm. in length; by the second about 160; by the third about 180. The following spring they are mature and thereafter growth is much slower. A fish of 230 mm. (9 inches) may be six years old.

Sometimes fairly common in Sandy Hook Bay in June and July, ripe, ranging from 150 to 180 mm. in standard length, females slightly more numerous than males, no small fish recorded. Spent fish are occasionally taken in the latter part of July and early August.

SIZE: Reaches a length of about one foot.



126. Channel-bass  
*Sciaenops ocellatus* (Linnaeus)

DISTRIBUTION: Uncommon in summer at the western limits of the region, May to October. *Woods Hole*, one record. *New York*, almost unknown on the Long Island and not rare on the New Jersey shore, May to October, rare in Sandy Hook pound nets, one of 2 feet 8½ inches, Sandy Hook Bay, September 13, 1921, and another somewhat larger on June 18, 1924.

Occurs on the Atlantic coast of the United States on sandy shores from New York to Texas.

Channel bass furnish excellent sport, being frequently angled for through the surf. The large ones, over 15 pounds, are coarse and not very good eating. They are rare in this immediate vicinity but common farther south on the New Jersey coast. The species feeds on mollusks and crustaceans. The name "red drum" is current for this species in the literature, but the "red drum" of the best informed New Jersey anglers is a true sea drum.

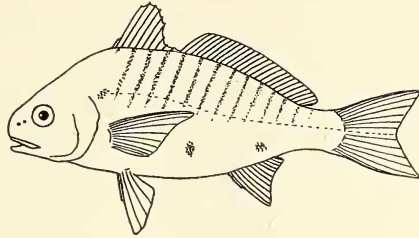
LIFE HISTORY: The channel bass does not normally range further north than New Jersey and apparently most of the breeding is done south of the Chesapeake Capes. The breeding season is confined to the late fall and early winter. The eggs and larvae are unknown, the smallest example on record being 40 mm. long. The general form of the adult is present at this stage, although the color markings are quite different, the small fish being blotched rather gaudily. Three year old channel bass may vary from 390

to 590 mm. ( $15\frac{1}{4}$  to  $23\frac{1}{8}$  inches) in length. In the 6th year they may measure about 826 mm. ( $34\frac{1}{4}$  inches).

SIZE: Reaches a length of 2 to 5 feet and weight of 10 to 75 pounds.

### 127. Spot

*Leiostomus xanthurus* Lacépède



DISTRIBUTION: Common in summer and fall, May 19 to December 29; every few years becomes very abundant. *Woods Hole*, small specimens common in fall, throughout October. *Orient*, common in summer and especially in fall May 19 to November 27 (December 15, 1908). *New York*, common, June 1 to December 29, most numerous in September.

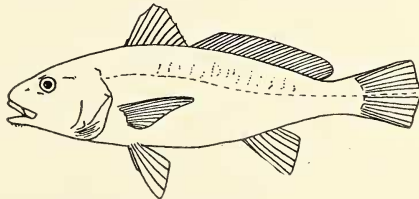
Occurs from Cape Cod to Texas. At intervals of several years the spot, locally called *Lafayette*, becomes excessively abundant about New York (as in 1925) when it became necessary to shut down the generators of the Brooklyn Edison Company to permit their crews to shovel out the fish) and may be caught in numbers from piers along the city's waterfront. A few may be found in this vicinity any summer.

LIFE HISTORY: The spawning season of the spot is in the late fall and early winter. The eggs and larvae are unknown and the smallest post larvae recorded has a length of 19 mm. (from Chesapeake Bay). Delaware Bay marks the northern limit at which this species spawns in any considerable numbers. From an examination of the scales it is inferred that the rate of growth is somewhat as follows: one year old fish average 100 mm.; two years 195 mm.; three years 265 mm. Young spot somewhat resemble the young of *Micropogon undulatus* but the squarely truncate tail of the former at once distinguishes it. The maximum recorded size for this species is 300 mm. ( $11\frac{3}{4}$  inches) but such examples are rare. About 270 mm. seems to be the average for the large sized fish.

SIZE: Reaches 12 inches in total length and a weight of  $\frac{3}{4}$  pounds.

### 128. Croaker

*Micropogon undulatus* (Linnaeus)



DISTRIBUTION: Irregularly common in summer and fall at our western

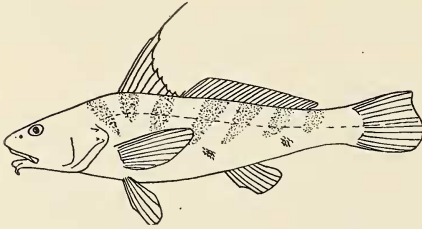
limits. June 13 to October 22 (adult) November 26 (young). *Woods Hole*, once, September 9, 1893. *New York*, common some years June 13 to October 22 (adult) November 26 (young).

Occurs generally common from New York City to Texas on sandy shores.

Young croakers,  $2\frac{1}{2}$  to  $3\frac{1}{2}$  inches total length, have been taken from the stomach of a red-throated loon in November.

**LIFE HISTORY:** The spawning season of this species is a long one, extending from August to December and possibly later to the southward. Spawning usually takes place in the larger bays and estuaries. The eggs and larvae are not known, and the smallest post larvae that have been examined measured 11 mm. There is little resemblance to the adult at this stage. The central rays of the caudal fin are produced considerably. By the time a length of 80 mm. has been reached a definite resemblance to the adult can be seen, although the caudal rays are still produced centrally. In the early fall young croakers about 25 mm. long sometimes may be taken on the oyster beds in lower New York bay and other places. In the first winter croakers average 40 mm., the second 150, the third 220, and the fourth 265 mm. ( $10\frac{1}{2}$  inches). Maturity is reached in the third or fourth year.

**SIZE:** Reaches a length of one foot or more.



### 129. Kingfish

*Menticirrhus saxatilis* (Bloch and Schneider)

**DISTRIBUTION:** Rather common in summer and fall, April 28 to December 8. *Woods Hole*, adults common in June, uncommon after July 15, young found till early October. *Orient*, April 28 (1913), April 29 (1910), average May 7, to December 8. *New York*, not uncommon, May 15 to November 4.

Occurs from Cape Ann to Florida, most common northward of Chesapeake Bay to Cape Cod, casually to Casco Bay, Maine.

The kingfish is common on sandy ocean shores and is frequently taken by casting through the surf, as is the larger striped bass. It lives at or near the bottom, preferably a sandy one.

**FOOD:** Crabs, squid, amphipods, isopods, shrimps, worms, young fish, bryozoa (*Woods Hole*).

**LIFE HISTORY:** Adults full of spawn in June (*Woods Hole*). The spawning season of the kingfish on the Jersey coast is centered in late June and early July. The eggs are buoyant, very faintly yellowish, transparent and spherical, measuring from 0.76 to 0.92 mm. in diameter. From one to ten

or more oil globules may be present in the yolk. If more than one they coalesce as development advances so that on hatching all possess but one. The period of incubation is about 48 hours at 69° F. The newly hatched larvae measure from 2 to 2.5 mm. and are practically helpless, floating in an inverted position while they await the absorption of the yolk sac. By the fifth day the sac is gone and the fry are more active, but the increase in length has been very slight.

Post larval kingfish come closely to resemble the adults at a much smaller size than any other Sciaenid we know of. At a size of 30 to 40 mm. the agreement in all essential features is close. Fish hatched in June may attain a length of 20 mm. by July 1, 80 mm. by August 1, and over 150 by September 1. This is when rapid growth is possible and conditions are especially favorable. Usually however, fish hatched in June or early July reach a length of 100 mm. by this latter date.

The average length during the first winter is 120 mm., the second 250, and the third 350 (13.7 inches). Maturity is reached during the third or fourth summer, that is, at the age of two or three years. The males probably mature mostly in the second and the females mostly in the third.

In support of the preceding general statements concerning the rate of growth of this species, the following actual measurements made on fishes taken in Sandy Hook Bay during 1923 are given:

Date	Average Standard Length
August 2, 1923	42 mm.
" 9, "	48 "
" 16, "	49 "
October 9, "	95 "
" 19, "	100 "

In 1925 the growth rate was apparently as follows:

Date	Average Standard Length
July 29, 1925	30 mm.
August 13, "	45 "
September 3, "	115 "
October 1, "	120 "

These figures may represent two groups, as the increase between August 13 and September 3 appears to be too great. In any event they represent the actual average lengths of fish taken on the respective dates.

New York lies just beyond the northern limit of the range of *Menticirrhus americanus*<sup>8</sup> which so closely resembles *M. saxatilis*. It appears in company with the latter on the Jersey coast in late summer. Spawning is apparently somewhat later than that of *saxatilis*, nearly ripe fish having been seen at

<sup>8</sup> Outer teeth of upper jaw moderately enlarged, filamentous tip of first dorsal reaching past front of second. Sides sharply marked with dark.

*M. saxatilis*

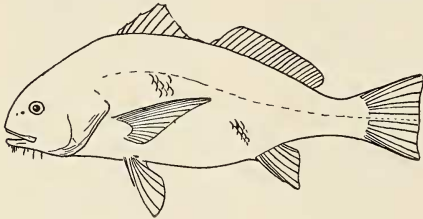
Outer teeth of upper jaw greatly enlarged, filamentous tip of first dorsal usually not reaching second. Dark marking on sides obscured.

*M. americanus*



Atlantic City (just south of our range) as late as August. Apparently in Florida waters they spawn still later, or there may even be two spawning seasons. The eggs and larvae are unknown. At a length of 20 or 30 mm. the resemblance to the adult is already marked, both in form and coloration. Maturity is attained in about three years. The growth in northern waters seems to be somewhat slower than that of *M. saxatilis* but this is to be expected near the northern limit of the range of a species.

SIZE: Averages 2 to 3 pounds in weight, grown fish being from one to 6 (?) pounds. An individual  $16\frac{3}{4}$  inches total length from Orient, weighed 2 pounds.



130. Sea Drum

*Pogonias cromis* (Linnaeus)

DISTRIBUTION: Rare to the eastward, rather common to the westward, summer and fall, May to December 18. *Woods Hole*, very rare (May), September and October. *Orient*, June 14 to September 1, only a few recent records, 5 such in 20 years. *New York*, rather common, May to December 18.

Occurs on the Atlantic and Gulf coasts of the United States from Long Island (casually Massachusetts Bay) to the mouth of the Rio Grande. Also recorded from the South American coast south to Argentina.

The sea drum has stony, paved teeth in its throat for crushing shellfish. It makes a loud, peculiar grunting sound, "wop, wop," so that a talkative school can sometimes be heard swimming past under a boat lying quietly at anchor. It is caught by surf fishermen from the New Jersey shore, and its large size recommends it to these sportsmen, though they generally consider that in fighting qualities it is inferior to the equally large, more slender and athletic channel bass, which is taken in the same waters.

Young fish are conspicuously marked with broad vertical black bands. Large ones are as a rule uniformly dark blackish. On the New Jersey coast certain large individuals are coppery red in color. They seem to possess a slightly different contour from the others, and are known as "red drum," but no technical differences to distinguish them are known, nor is it certain what is the cause of the difference.

LIFE HISTORY: The life history of the sea drum is practically unknown, the smallest examples recorded being 3 inches long. At this length they are in the barred condition common to them up to a foot or more. There is a regular summer migration to the New Jersey coast which may have some connection with breeding habits. The fish which appear there are usually in excess of 20 pounds, although banded examples as small as 12

pounds have been occasionally taken. There is recorded an angler's catch of a fish weighing 146 pounds from Florida, and examples up to 60 pounds are not rare.

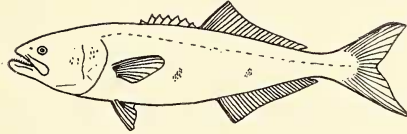
**SIZE:** Reaches 4 feet standard length. The largest recorded weighed 146 pounds.

### BLUEFISH

A symmetrical, swift-swimming, active, predacious fish, with a small, low dorsal fin of slender spines, before the longer, soft-rayed second dorsal, similar to the anal beneath it. Scales fine and rough. Caudal very deeply and strongly forked and with a narrow peduncle, which has neither keel nor scutes.

#### 131. Bluefish

*Pomatomus saltatrix* (Linnaeus)



**DISTRIBUTION:** Abundant in summer, middle of May to November 28, common from mid-June to mid-October, the young somewhat later. *Woods Hole*, abundant, arrives middle of May to first week in June, most numerous in July and October. *Orient*, adults June 1 to October 5, young to November 28. *New York*, abundant, May to October. There is a regular long-shore migration of the largest young of the year in September and October, when they are taken abundantly in the traps on the New Jersey coast. At *Orient* the largest young ("snappers") school up and enter the Sound between September 25 and October 15. Beyond that date those still present are gradually smaller.

Occurs in the warmer parts of the Atlantic, and in the Indian Ocean, and has increased in numbers on our Atlantic coast within historic times. Its limit to the northeast appears to be Penobscot Bay. Apparently subject to wide fluctuations in numbers over long periods.

Bluefish schools occur in the Indian Ocean as well as in the Atlantic but are not known in the Pacific. The fish's stay with us is confined to the warm months though it may be found further south on the coast throughout the winter. It is tremendously destructive to smaller species, especially to the schools of menhaden. It grows rapidly and furnishes exceptionally fine food as well as sport. The bluefish is the salt water species which can pre-eminently be taken by trolling with a shiny metal "squid" in place of any bait. In late summer and fall the young of the bluefish known as "snappers" furnish excellent sport on light tackle in inshore waters.

Bluefish are taken commercially by lines more than by nets to which they are very destructive. There is a fishing ground near Sandy Hook where a great many are taken by chumming with hand-lines from boats. One man is kept busy grinding menhaden and throwing it overboard to form an unbroken strip of chum, cutting the back from each menhaden as he does so,

to serve as a bait. The others haul in the bluefish, which work up through the chum, hand over hand, about as quickly as they can bait and throw over their lines. It is strenuous work for the crew, who are exhausted after about two hours of it. Finally, when tired out or when the fish suddenly stop biting, one of the boats starts back to the city, and they all follow, racing to get to market before the catch shall have sent down the price of fish.

The larger bluefish occur off shore, smaller ones in the bays. Though their game qualities may be superior, they are accessible to a far smaller number of New York city anglers than the weakfish.

FOOD: Very voracious, preying on squid and various fish,—hake, herring, scup, cunner, noted at Woods Hole. The young eat small fish as a rule, *Menidia* being a favorite, but shrimps and amphipods also eaten. When some 7 or 8 inches in standard length, they prey on small butterfish and spot.

LIFE HISTORY: A few have well-developed spawn on arrival, young of the year  $1\frac{1}{2}$  inches long ordinarily first seen in July, though noted as early as May 29 (Woods Hole). Young of  $1\frac{1}{4}$  to  $1\frac{5}{8}$  inches total length were abundant in the Sound at Orient, June 10, 1918, they having just appeared that day. By October 11 most of the fish hatched in spring are about 6 inches standard length (Sandy Hook Bay).

The bluefish spawns in the spring in our latitudes, but little is known of its development though it has probably one of the fastest rates of growth of any vertebrate animal. This belief is founded on the following considerations: Among vertebrates, at least, the highest rate of growth is doubtless to be found among those which need expend a minimum of energy to move their bodies, and possess a minimum of weight to carry. This at once limits the case in point to aquatic animals, as with them weight is practically annihilated and the adjustments of fishes such as *Pomotomus* for locomotion are perfected to a remarkable degree. They are especially formed for ease of locomotion, and the mechanical perfection of their locomotor apparatus is extreme. So, when it is considered that the bluefish is one of these, and furthermore, is one of the most rapacious feeders known, it is not a tax on the imagination to believe that much of the food consumed gives rise to a prodigious growth. In 1921 a series of young bluefish taken in Sandy Hook Bay made possible the construction of the following very smooth growth-curve, without the same having been smoothed or 'doctored' in any way, but standing just as plotted:

	<i>Date</i>	<i>Average Standard Length</i>
June	23, 1921	46 mm.
"	29, "	56 "
July	7, "	67 "
"	27, "	83 "
August	25, "	113 "

After this date multimodal curves began to appear on plotting, and it is our belief that other schools of bluefish spawned earlier and later, began to

minge with this group. The one other date which matches well with the above series is that of October 17 on which day one of the modes was 151 mm.

Producing this curve downwards it coincides well with a spawning occurring in the latter part of May:

Date		Average Standard Length
July	26, 1923	70 mm.
August	2, "	95 "
"	9, "	100 "
"	16, "	120 "
"	23, "	125 "
"	30, "	135 "
September	6, "	137 "
October	9, "	155 "
"	19, "	176 "

Here again multimodal curves began to appear in the fall, but were so far below as to force the conclusion that they represented other schools. For example, on October 9 a mode appeared at 76 mm., leaving a large gap between it and that of 155 mm. with no intermediates.

Young bluefish taken by Robert R. Fridenberg at Freeport, Long Island, during 1925, showed the following average growth in total lengths:

Date	Total Length	Weight
August 10, 1925	6 inches	1 ounces
" 24, "	7 "	2 "
September 10, "	8 "	3 "
October 5, "	9 $\frac{1}{8}$ "	4 $\frac{1}{4}$ "

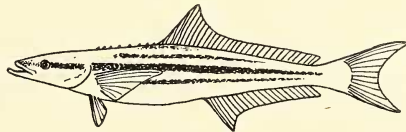
SIZE: Not infrequently weighs 10 lbs; largest Orient specimen measured 32 $\frac{1}{2}$  inches total length; 27 pounds, with a total length of 45 inches, is the largest of which there is recent record. Early in the season off-shore bluefish average about 6 pounds in weight. Later, 10 pound fish are not unusual. A century or more ago they are said occasionally to have been taken up to 40 or 50 pounds.

### SARGENT FISHES

Slender fishes with large mouth and projecting lower jaw, moderately forked caudal. Along soft dorsal over the almost equally long anal. The spinous dorsal consists of low isolated spines in advance of the soft dorsal.

#### 132. Cobia

*Rachycentron canadus* (Linnaeus)



DISTRIBUTION: Rare in summer, both young and adults, June to September. *Woods Hole*, rare, records for July and September. *New York*, rare, June to Sept. 13 (1925, Jones Inlet, L. I., slightly over 3 inches in total length).

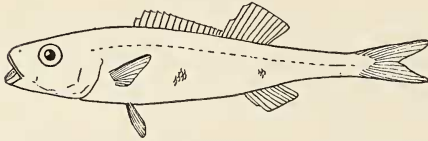
Occurs cosmopolitan in warm seas, rather common in Chesapeake Bay and southward.

FOOD: Feeds on any fish, among which the weakfish has been recorded; usually bottom forms such as flounders, also crabs, etc. Very voracious.

SIZE: A  $4\frac{3}{4}$  feet specimen from Woods Hole weighed over 60 pounds.

### SQUARE-TAILS

The square-tail is a peculiar fish of the open Atlantic with no near relatives. It is moderately elongate and symmetrical, with a large eye, spiny and soft-rayed dorsal fins joined at the base, and a small, well forked caudal fin. Its special peculiarities include fine, hard, grooved, ciliated scales, and box-like jaws with a single series of close-set comb-like teeth.



133. **Square-tail**  
*Tetragonurus cuvieri* Risso

DISTRIBUTION: Accidental, Woods Hole, November 10, 1896 and Vineyard Sound, August 1, 1899 (taken with a dip-net among floating weed).

Occurs on the coast of southern France and at the Madeira Islands.

SIZE: One of the Woods Hole specimens was about 3 inches in length.

### HARVEST FISHES

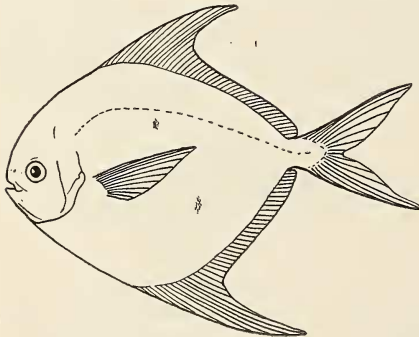
Small fishes with caudal forked, peduncle narrow. Soft dorsal and anal fins long and similar. No obvious spinous dorsal or dorsal spines. Ventral fins absent or rudimentary.

Dorsal and anal fins high, falcate. The body deep.

*Peprilus*

Dorsal and anal fins moderately elevated in front, the body less deep, side of back with a series of large pores.

*Poronotus*



134. **Harvest Fish**  
*Peprilus paru* (Linnaeus)

DISTRIBUTION: In varying numbers, usually uncommon, summer and



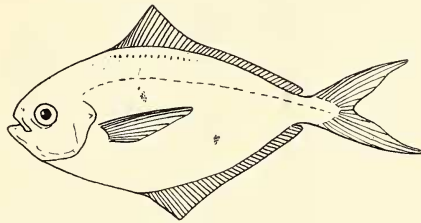
fall, during June to October 20. *Woods Hole*, usually rare, occasionally common, present during June and July. *Orient*, rare, September 12 to October 20. *New York*, sometimes common, June 28 to September 17.

Occurs from Cape Cod to the West Indies and Brazil. Young sometimes found swimming beneath the Portuguese-man-of-war with *Nomeus gro-novii*. Almost invariably two are taken at a time (*Orient*).

**SIZE:** Reaches a length of 8 inches. During 1923 this species was especially common in Sandy Hook Bay. A small series taken on August 16 averaged 141 mm. in standard length and showed a maximum of 155 and a minimum of 135.

### 135. Butterfish

*Poronotus triacanthus* (Peck)



**DISTRIBUTION:** Abundant in summer and fall, (April 21) May 3 to December 1. *Woods Hole*, abundant, May 11 to late fall, an especial run in June lasting one or two weeks. *Orient*, abundant, April 21, (average May 3) to December 1. *New York*, abundant, May to October 21, most numerous in August and September.

Occurs from Nova Scotia to Cape Hatteras, thence in deep water to Florida, abundant northward.

The attractiveness of this delicately flavored fish for the table is frequently diminished by the presence of abundant cestode cysts throughout its muscles.

**FOOD:** Large ones eat small fish and squid. Smaller specimens feed on copepods, annelids, and small fish, and in September principally amphipods, in pursuit of which they venture so close to the breakers along ocean beaches as to be frequently thrown ashore.

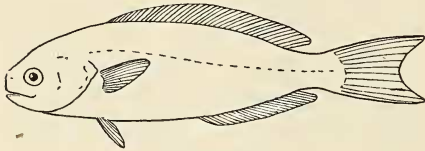
**LIFE HISTORY:** Spawns in June; the young are often observed swimming under jellyfish (*Woods Hole*). Young 1 to 4 inches total length common in fall, to December 1 (*Orient*).

With the coming of summer most of the butterfish leave shoal water. The spawning takes place chiefly in July. The eggs are spherical, buoyant, transparent and range from 0.7 to 0.8 mm. in diameter. A single oil globule is usually present. Incubation occupies less than 48 hours at 72° F. The larvae are about 2 mm. long at the time of hatching. The vent is lateral and immediately behind the yolk sac. After a length of 20 mm. has been reached the general appearance of the adult is assumed. Occasionally in October (*Sandy Hook Bay*) small ones of about 22 mm. standard length are taken close to shore in loose eel grass.

**SIZE:** Butterfish from Sandy Hook Bay average about 11½ inches in standard length during July, with another group averaging about 5 inches. The former is near the ordinary maximum for the species.

### RUDDER FISHES

Grouped here we have two somewhat dissimilar fishes of the open sea, with caudal fin moderately forked, peduncle moderately narrowed, soft-rayed back fin long and level, in one case with a few short isolated spines before it (*Palinurichthys*), in the other with its first few rays spinous, little differentiated from the remainder of the fin (*Centrolophus*). Scales small, smooth, inconspicuous.

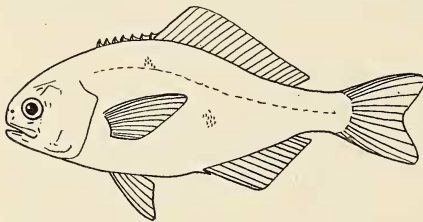


136. **Black Ruff**  
*Centrolophus niger* (Gmelin)

**DISTRIBUTION:** Accidental, one record, off Dennis, Mass., November 23, 1888.

Occurs off the coasts of southern Europe, not rare in rather deep water.

**SIZE:** The local record is of an individual 9 inches long.



137. **Black Rudder-fish**  
*Palinurichthys perciformis* (Mitchill)

**DISTRIBUTION:** Common to the eastward, uncommon to the westward, summer and fall, June to October 21. *Woods Hole*, common and generally distributed, June to October. *Orient*, rare (August 31, 1907) October 1 to October 21. *New York*, uncommon, August to October.

Occurs in the western Atlantic from Cape Hatteras to Nova Scotia, most abundant south of Cape Cod casual in Great Britain. Found in gulfweed or other floating objects and under anything adrift.

"*Palinurichthys perciformis* was more abundant in Vineyard Sound during the latter part of August [1920] than during any of the numerous occasions extending over 25 years when I have been at Woods' Hole. On certain days almost every floating box, barrel, plank and mass of eel-grass or rock-weed served as a shelter for this rudderfish, and some of the larger rafts of seaweed covered hundreds of specimens ranging from 6 to 12 inches long. Many were secured with a small dipnet thrust suddenly under bits of seaweed from a slowly moving motor boat." (H. M. Smith, *Copeia*.)

FOOD: Sundry small fishes, squid, small crustacea (including barnacles), univalve mollusks, etc.; algae have also been found in their stomachs.

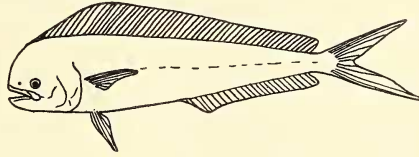
SIZE: Reaches  $13\frac{3}{4}$  inches total length,  $1\frac{1}{2}$  pounds weight.

### DOLPHINS

Slender, compressed, extremely active, free-swimming fishes with a very deeply and strongly forked caudal, a firm narrow peduncle without keel or scutes. Dorsal fin high, extending the length of the back, entirely of flexible spines or jointless rays.

#### 138. Dolphin

*Coryphaena hippurus* Linnaeus



The dolphin is elongate in form tapering gradually from the shoulder to the tail. Adult males have a very high, thin, vertical forehead. It is one of the most brilliantly colored and changeable fishes; vivid blues and yellows run across the sides of a living example like the shadows of clouds.

DISTRIBUTION: Casual in late summer July to September. *Woods Hole*, adults very rare, a few young taken nearly every year in floating gulfweed, recorded for July and August. *New York*, casual, August and September.

Occurs cosmopolitan on the high seas, partial to blue water.

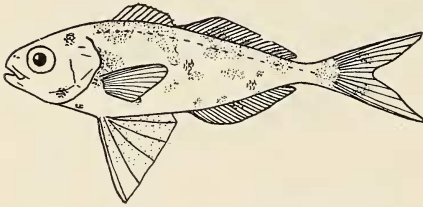
The dolphin is perhaps the swiftest fish that swims in the seas. A thousand miles of azure sea before it, a thousand miles of azure sea behind, it slips through the water swift and deadly as a brilliant colored knife; and any flying-fish in its path slow in gaining the air, promptly changes from incentive to motive power.

It associates in small schools which prey almost exclusively on the flying-fish, and is frequently caught from deep-water sailing ships on a hook set in a piece of wood over which a white rag is draped. This lure is barely allowed to touch the water and is then jerked into the air again, and doubtless simulates a flying-fish to the eye of the dolphin below. Sailors say that this species is sometimes poisonous and should be cooked with a piece of bright silver. If the silver stays bright, that particular fish can be eaten. Considerable confusion seems to have existed for a long time in regard to the word dolphin, which is used almost exclusively for porpoises except among deep-sea sailors, where it is applied only to this fish. The figures of dolphins on the old Greek coin are of the porpoise, and the dolphin of heraldry was a combination of these two unlike marine creatures, often with tusks indicative of the porpoise's resemblance to a pig, but with the long spiny fin on the back characteristic of the fish. Very small dolphins hide in drifting weed or about floating wreckage and have a mottled white and yellow concealing color.

SIZE: Reaches a length of about 6 feet.

## MAN-OF-WAR FISH

A small, symmetrical, fork-tailed fish, with bold vertical dark cross-bands, which seldom strays far from the tentacles of the drifting Portuguese-man-of-war (*Physalia*) beneath which it seeks shelter. Ventral fins broad and black.



139. **Man-of-war Fish**  
*Nomeus gronovii* (Gmelin)

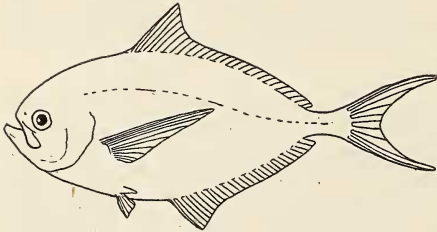
**DISTRIBUTION:** Uncommon in the Woods Hole region, July and August, unknown elsewhere.

Occurs cosmopolitan, pelagic, in warm seas. Found only in company with the Portuguese-man-of-war, finding shelter in proximity to the dangerous stinging tentacles of the drifting communal jellyfish.

**SIZE:** Reaches a maximum total length of 6 or 8 inches.

## POMFRETS

Pelagic or deep-sea fishes with a forked caudal and narrow firm peduncle like mackerels and crevallys, but with rather large scales.



140. **Pomfret**  
*Brama rai* (Bloch)

**DISTRIBUTION:** Accidental, one record, No Mans Land, August 9, 1904. Occurs cosmopolitan, pelagic, usually at considerable depth.

**SIZE:** Reaches a length of about 6 inches.

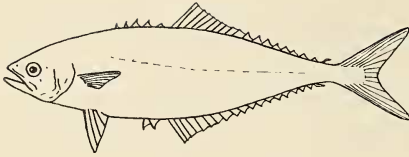
## CREVALLYS

Compressed, more or less silvery, actively free-swimming fishes with a strong deeply forked caudal fin, and a firm, narrow peduncle. Soft dorsal and anal long and similar. Peduncle armed either with enlarged keeled scales, that is scutes, or with a fleshy keel. Such armature lacking in certain exceedingly deep-bodied compressed silvery forms, and in the pompanos

which resemble certain harvest fishes but have ventrals present. Scales fine and smooth or rudimentary. Premaxillaries usually protractile.

- a. Scales linear, embedded, so as to reinforce a silvery leathery skin, peduncle unkeeled, premaxillaries not protractile (except in the very young). *Oligoplites*  
Scales not linear, premaxillaries protractile (see b).
- b. Anal fin much shorter than soft dorsal, preduncle with a keel, but without enlarged keeled scales (see c).  
Anal fin about as long as soft dorsal, peduncle usually with enlarged keeled scales. Pectoral fin more or less falcate (see d).  
Anal fin about as long as soft dorsal, peduncle without keel or enlarged keeled scales. Pectoral not falcate. *Trachinotus*
- c. No detached dorsal and anal finlets, body normally compressed, mouth moderate. *Seriola*  
No detached dorsal and anal finlets, body cylindrical, cigar-shaped, mouth small. *Naucrates*  
A detached dorsal and anal finlet. *Elagatis*
- d. Dorsal outline equally or more strongly curved than ventral (see e).  
Ventral outline more strongly curved than dorsal. *Chloroscombrus*
- e. Lateral line with enlarged keeled scales on its entire length. *Trachurus*  
Lateral line with enlarged keeled scales on its posterior part or confined to the peduncle (see f).  
Lateral line without enlarged keeled scales, body elevated and strongly compressed, dorsal and anal lobes produced. *Selene*
- f. Dorsal and anal followed by a detached finlet, body slender. *Decapterus*  
No finlets. Shoulder girdle with a deep cross furrow, above which a fleshy projection. *Trachurops*  
No finlets. Shoulder girdle normal, not as above (see g).
- g. Body moderately compressed, keeled scales on peduncle well developed. *Caranx*  
Body very deep and compressed, scales exceedingly small or obsolete except for a few enlarged keeled ones on peduncle (see h).
- h. Dorsal and anal rays produced, filamentous, sides crossed with dark bands. *Alectis*  
Dorsal and anal low, sides uniform silvery, except for a black central spot in the very young. *Vomer*



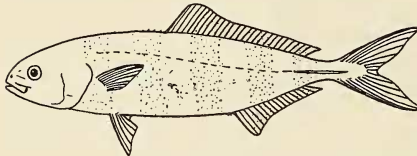


141. **Leather-jacket**  
*Oligoplites saurus* (Bloch and  
Schneider)

**DISTRIBUTION:** Rare, August 13 to October, apparently most frequent to the west. *Woods Hole*, four records; August 13 and September. *New York*, occasional in summer, to October.

Occurs on both Atlantic and Pacific coasts of tropical America ranging north to New York and Lower California.

**SIZE:** Reaches a length of about one foot or more.



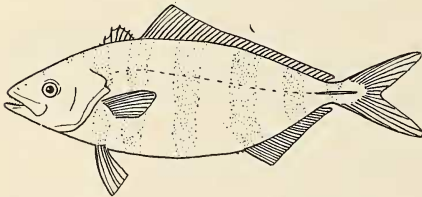
142. **Pilot-fish**  
*Naucrates ductor* Linnaeus

**DISTRIBUTION:** Casual to the eastward. *Woods Hole*, casual, has occurred at least three times, September 9 and 10.

Occurs cosmopolitan in all warm seas well off shore, casually north to Seguin Island, Me., on our coast.

The pilot-fish follows ships and off-shore sharks. It is closely related to coastwise fishes of the genus *Seriola*, which when young swim under jelly-fishes and drifting weed and, somewhat later, follow boats and coastwise sharks or frequent drifting wreckage. Such young *Seriolas* are banded in color, but as they attain adult proportions lose the bands, and at the same time leave the shelter of drifting objects or of larger fishes and navigate independently. The pilot-fish retains its "pilot" habits, as also its bands throughout life. It may be considered a larval or juvenal form which has become fixed.

**SIZE:** Reaches a length of 2 feet.



143. **Banded Rudderfish**  
*Seriola zonata* (Mitchill)

Dorsal soft rays 36 to 38. Size small.

**DISTRIBUTION:** Rather common, summer and fall, July 21 to November 12. *Woods Hole*, rather common July to October. *Orient*, rather com-

mon, August 1 to November 12. *New York*, rather common, July 21 to November 8, most plentiful in late August and early September.

Occurs from Cape Cod (casually Massachusetts Bay) to Cape Hatteras and beyond (Gulf of Mexico?).

"Several specimens, 5 to 7 inches long, taken under floating material in Vineyard Sound and kept in the aquarium of the Bureau of Fisheries during parts of August and September. In the absence of a suitable hover, this species will seek refuge under almost any small objects. In the aquarium, a smaller specimen used to swim under a larger one and both sought the protection of a threadfish (*Alectis ciliaris*) only 5 inches long" (H. M. Smith, in *Copeia*).

The banded rudder fish is a trimly built species, generally a few inches long, swimming in small schools with a tendency to follow boats or to linger about buoys or drifting logs. It sometimes accompanies in-shore sharks, much as the related pilot-fish accompanies those further out to sea.

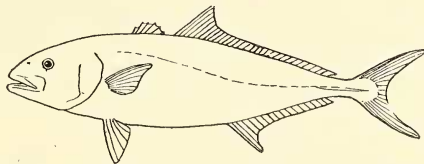
FOOD: Fish (menidia, etc.).

LIFE HISTORY: A specimen ten inches total length retained full black bands, one of 11¼ inches, the smallest taken without trace of bands.

SIZE: A local record of 14½ inches total length, 1¾ pounds weight (Orient). Said to reach 2 or 3 feet.

#### 144. Great Amber-jack

*Seriola lalandi* Cuvier and Valenciennes<sup>9</sup>



Dorsal soft rays 30 to 34. Slender, depth 3½ to 3¾ in standard length.

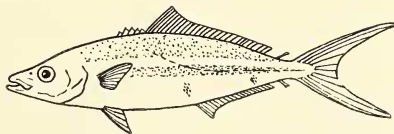
DISTRIBUTION: Rare or casual in summer. *Woods Hole*, never common, summer. *New York*, casual, July and August.

Occurs from Florida to Brazil, straggling north to New Jersey.

SIZE: Reaches 5 or 6 feet.

#### 145. Runner

*Elagatis bipinnulatus* (Quoy and Gaimard)



DISTRIBUTION: Accidental in summer. *New York*, August.

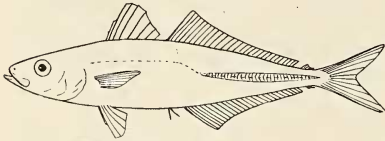
Occurs cosmopolitan in tropical seas, rare in the West Indies, recorded north to Long Island.

<sup>9</sup> The small amber-jack, *Seriola dumerili*, has been recorded from Woods Hole, but the 2 or 3 records for it are open to question. It occurs regularly as far north as Florida; is deeper than *S. lalandi* (depth about 3): and reaches a somewhat smaller size, 2 feet or more long.

The runner is a large off-shore fish, brightly colored, bluish above, yellow below and on the tail, with two conspicuous blue lengthwise bands on either side of the body. Large ones are usually rather solitary.

A troop of fifty or more young runners as well as several pilot-fish were observed by R. C. Murphy accompanying a 7-foot shark in equatorial mid-Atlantic.

SIZE: Reaches a length of somewhat over 3 feet.



**146. Round Scad**

*Decapterus punctatus* (Agassiz)

Deeper, depth 5.0 in length to notch of caudal fin. Scutes on peduncle well developed.

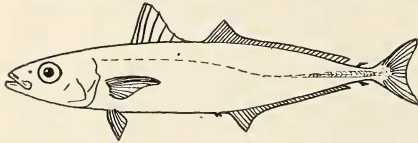
DISTRIBUTION: Irregularly common in summer and fall, June 18 to November 20. *Woods Hole*, uncommon, August 11 to October 10. *Orient*, irregularly common, June 18 to November 20. *New York*, sometimes common, July.

Occurs from Cape Cod to Brazil.

FOOD: Young feed on copepods and annelids (*Woods Hole*).

LIFE HISTORY: Young less than 2 inches in total length, L. I. Sound, June 18 to late August; 2½ to 3½ inches, September 12 (*Orient*).

SIZE: Reaches a length of 12 inches.



**147. Mackerel Scad**

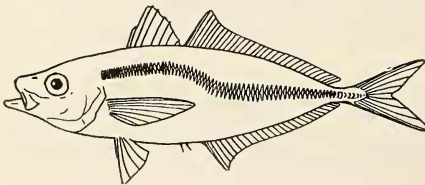
*Decapterus macarellus* (Cuvier and Valenciennes)

Less deep, depth 5.3 to 6.0 in length to notch of caudal fin. Scutes on peduncle little developed.

DISTRIBUTION: Reported sometimes abundant in fall at *Woods Hole*, as late as November 22, unknown to the West.

Occurs in warm waters of the Atlantic, straying north to Cape Cod (casually Nova Scotia) though uncommon on the American coast, races or allied species of this fish cosmopolitan in warm seas.

SIZE: Reaches one foot in length.



**148. Rough Scad**

*Trachurus lathami* Nichols

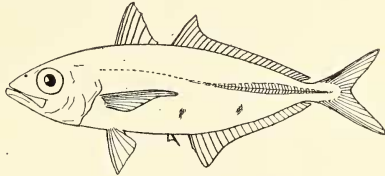
**DISTRIBUTION:** Very rare in late summer and fall, August 28 to November. *Woods Hole*, one record, Newport. *Orient*, rare, August 28 to November 1. *New York*, accidental, October.

Occurs off the Atlantic coast of America, young about the Florida Keys (numerous off Key West, Feb. 23, 1910), adults probably along the western edge of the Gulf Stream. A related form is a common market-fish in Northern Europe.

**SIZE:** Reaches a length of about 9 inches.

**149. Goggle-eyed Scad**

*Trachurops crumenophthalmus*  
(Bloch)



**DISTRIBUTION:** Rather common in late summer and fall, August 1 to November 15. *Woods Hole*, common every fall, August 7 to November 15. *Orient*, not uncommon, August 1 to November 13. *New York*, not uncommon September to October 12.

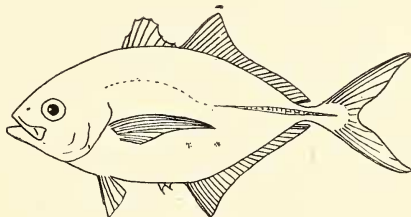
Occurs cosmopolitan in warm seas, north to Cape Cod.

**FOOD:** Probably feeds mostly on small fish; annelids have been recorded as a food item at Woods Hole.

**SIZE:** Reaches a length of 10 inches.

**150. Yellow-jack**

*Caranx bartholomaei* Cuvier and  
Valenciennes



Front of soft dorsal and anal fin low, little projecting. Dorsal with 26 or 27, anal 22 or 23 soft rays. Less than 20 gill-rakers on lower limb of the arch. Breast completely scaled.

**DISTRIBUTION:** Rare but apparently regular to the eastward in fall, August to November, not known to the westward. *Woods Hole*, numerous records, August to November.

Occurs in the West Indies, young north commonly in gulf weed to the Capes of the Carolinas.

The colors of various jack fishes are bright silvery, iridescent, often with yellow, those of the present species peculiarly rich. Its general color is bluish silver more or less suffused with olive yellow, and with rich blue, purple, and sometimes green reflections, and becomes white on the mid-

line below. The top of the head is olive, and the mid-line of the back yellow, sometimes an olive yellow and again an orange yellow. The iris is golden and the fins greyish and olive yellow. It is characterized by the olive yellow suffusion and the richness of the colors throughout.

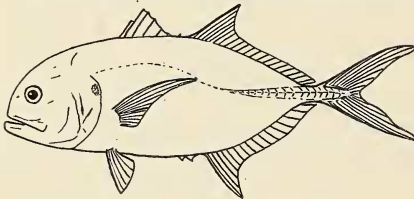
In Cuba the yellow-jack, under the name Cibi, is supposed at times to be unwholesome. It is under no such suspicion at Nassau, where it finds a ready market.

**LIFE HISTORY:** The young, some 2 inches in total length, hide about drifting gulfweed (April 20, off the east coast of Florida; in summer, at the Capes of the Carolinas). At this stage they are deep-bodied (about half as deep as long) with life colors calculated to give them low visibility among the weed. Golden olive with irregular bars of silvery white along the back and belly and spots of the same on side. Diffuse dusky bar through eye.

The young of most species of the genus *Caranx* are more or less deeper bodied than grown fish, and we have wondered if this might be in some way correlated with their drifting in ocean currents. The case of *C. bartholomaei* lends support to such an hypothesis. Associated with gulf weed, it is one of those that drifts most widely, it is also in general one of the deepest bodied species, depth being usually a good criterion to distinguish it from its close relative *C. ruber* which does not range sufficiently far north to reach our region.

Specimens under 6 inches in length (to base of caudal) have the depth contained  $2\frac{1}{2}$  or less times in this length, whereas specimens of *ruber* down to 4 inches have depth contained 3 times more or less, in length. In *bartholomaei* 6 inches to a foot long, however, depth falls off very rapidly, and there is no appreciable depth difference between the two species at the length of a foot. Specialized, notably deep and compressed genera allied to *Caranx* (*Alectis*, *Selene*, *Vomer*) are great drifters.

**SIZE:** Reaches a length of about 15 inches.



151. **Common Jackfish**  
*Caranx hippos* (Linnaeus)

Front of soft-dorsal and anal fins elevated, projecting. Dorsal with about 20, anal about 17 soft rays. Breast with a small patch of scales in its center only.

**DISTRIBUTION:** Rather common in-summer and fall, July 1 to October 30, young or small sized individuals. *Woods Hole*, rather common July 1 to late fall, most numerous in October. *Orient*, rather common, July 30 to October 30. *New York*, rather common, July to October. Less common than the hard-tailed jack in Sandy Hook Bay. Occurs on warm coasts of the Atlantic and eastern Pacific, north to Cape Cod.

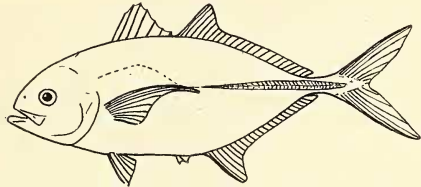


Diagnostic markings of this species are brightness of the yellow usually present on the lower parts, large black blotch on opercle, and especially a black spot on the lower pectoral rays.

SIZE: Reaches a length of about  $2\frac{1}{2}$  feet, and weight of about 20 pounds.

**152. Hard-tailed Jack**

*Caranx crysos* (Mitchill)



Front of soft-dorsal and anal fins elevated, projecting. Dorsal with about 24, anal about 19 soft rays. Breast fully scaled. Straight portion of lateral line unusually long and fully armed,  $1\frac{2}{3}$  times the arc of the curve.

DISTRIBUTION: Rather common in summer and fall, July 1 to November 4 *Woods Hole*, rather common, July 1 to late fall. *Orient*, rather common, July 18 (1911) to November 4. *New York*, rather common, July to October 21.

Occurs from Cape Cod (casually Massachusetts Bay and Nova Scotia) to Brazil, and on the Pacific coast of tropical America.

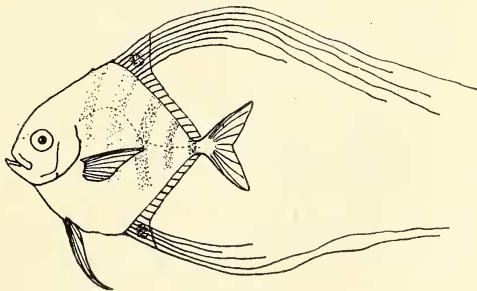
Under ordinary circumstances this species is characterized by the paleness and delicacy of its colors, kept in an aquarium it sometimes turns uniformly blackish, head, body and fins. Specimens from Sandy Hook Bay are usually golden yellow, sufficiently so to justify the name "*Crysos*," but in our experience in southern waters this might have been applied more appropriately to either of the two preceding.

FOOD: A predacious species, preying on other smaller fishes; shrimps very abundant in food of young in August (*Woods Hole*).

SIZE:  $21\frac{1}{2}$  inches total length, weight 4 pounds (*Orient*) the largest locally.

**153. Threadfish**

*Alectis ciliaris* (Bloch)

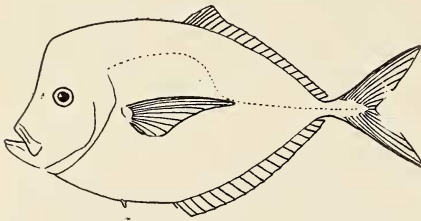


**DISTRIBUTION:** Rare in summer and fall, June 15 to November. *Woods Hole*, rare June 15 to November. *Orient*, once, Spetmber 11. *New York*, rare, July 29 to August 12.

Occurs cosmopolitan in tropical seas, young northward in the Gulf Stream and Japan Current.

This and the two following deep, compressed genera are evidently specializations of the more normally formed, freer swimming genus *Caranx*. In each case as these fish approach maximum size they become less aberrant in form, more *Caranx*-like. Hence we may argue that the genera have arisen by fixation of juvenal characters, great depth and compression of body, perhaps correlated with wide drifting of young fish in ocean currents.

**SIZE:** Reaches a standard length of 7 inches or more, usually smaller. There is an overgrown example of  $19\frac{3}{4}$  inches from the Hawaiian Islands in the American Museum of Natural History. Specimens taken during August in Sandy Hook Bay averaged about 4 inches in standard length.



#### 154. Moonfish

*Vomer setapinnis* (Mitchill)

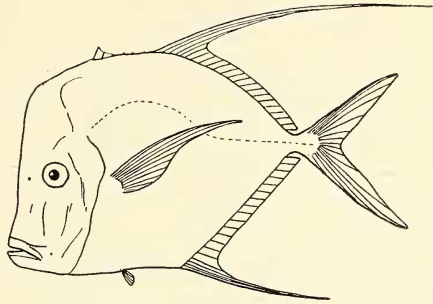
**DISTRIBUTION:** Irregularly not uncommon in summer and fall, June to November 5. *Woods Hole*, rare to common, August and September. *Orient*, sometimes rather common, September 1 to October 30. *New York*, usually uncommon, June to November 5.

Occurs from Cape Cod (casually Maine and Nova Scotia) to Brazil, including the West Indies, and on the tropical portion of the Pacific coast of America; a distinguishable local race, as well as the typical one, found in the West Indies, and a distinguishable race on the west coast of Africa. Adults occasional in Sandy Hook Bay. Young always common in late summer and fall.

The following data indicate a slow irregular rate of growth:

Date		Average Standard Length
August	24, 1923	45 mm.
"	31, "	47½ "
September	6, "	45 "
October	14, "	50 "

**SIZE:** Reaches a total length of about 12 inches.

155. **Lookdown***Selene vomer* (Linnaeus)

**DISTRIBUTION:** Uncommon in late summer and fall, August to October; young individuals. *Woods Hole*, not common, September and October. *Orient*, rare and irregular, September 17 to November 3, all very small individuals. *New York*, uncommon, August to October.

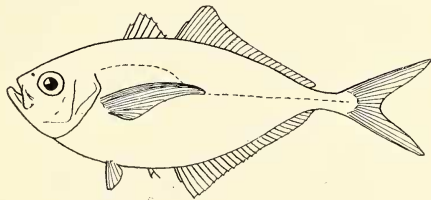
Occurs from Cape Cod (casually Casco Bay) to Brazil, and from Lower California to Peru. Not rare in Sandy Hook Bay, but not as common as *Vomer setapinnis*. Large ones about as common as small.

<i>Date</i>		<i>Average Standard Length</i>
July	27, 1923	44 mm.
October	19, "	65 "

On this latter date there was also taken an individual of 40 mm. which apparently belonged to another and later spawned group.

**LIFE HISTORY:** Young are somewhat deeper bodied, ventrals elongate, some of dorsal spines filamentous; filamentous dorsal spines and length of ventrals reduced in the adult, but filamentous lobes of soft dorsal and anal more extreme.

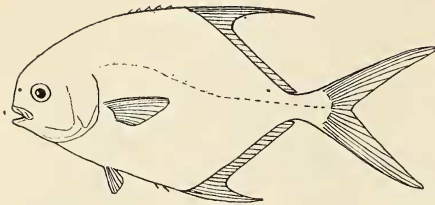
**SIZE:** Reaches a total length of about one foot.

156. **Bumper***Chloroscombrus chrysurus* (Linnaeus)

**DISTRIBUTION:** Casual in summer and fall, latest October 2. *Woods Hole*, no record. *Orient*, three records, September 12 to October 2. *New York*, accidental, summer.

Occurs from Cape Cod to Brazil.

**SIZE:** Reaches a length of about 10 inches.



157. **Round Pompano**  
*Trachinotus falcatus* (Linnaeus)

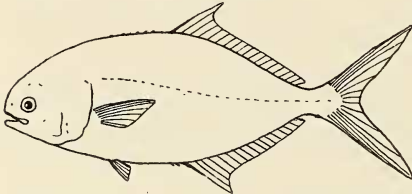
Dorsal with 19 to 20 soft rays, anal with 17 to 19; depth about  $1\frac{3}{5}$ .

**DISTRIBUTION:** Young sometimes common, July to October 18. *Woods Hole*, young very common some years, no adults taken, July to October 18. *Orient*, two definite records, September. *New York*, rather common, August to October.

Occurs from Cape Cod to Brazil.

**LIFE HISTORY:** Three examples about 24 mm. in standard length were taken on October 4 among the sea weed and debris close to shore in the "Horseshoe," Sandy Hook Bay, N. J. They were a smooth velvety black and the fins were hyaline. Two of these were kept in the Aquarium for a few weeks and lost this pigmentation, becoming a silvery color similar to the young of *T. carolinus*. The iris in life was a deep ruby red. One rather similar example of the same size was taken on July 9, 1925.

**SIZE:** Reaches a length of about 8 inches.

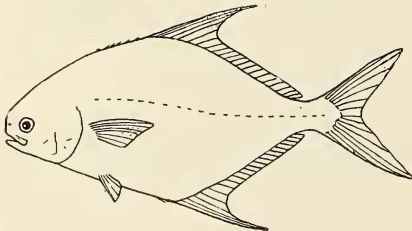


158. **Great Pompano**  
*Trachinotus goodii* Jordan and  
Evermann

Dorsal with 19 to 20 soft rays, anal with 17 to 19; depth about 2 to  $2\frac{3}{5}$ .

**DISTRIBUTION:** Several records for the young at *Woods Hole*, September. Occurs in the West Indies north to Florida. Uncommon.

**SIZE:** Reaches a length of 3 feet.



159. **Silvery Pompano**  
*Trachinotus argenteus* Cuvier and  
Valenciennes

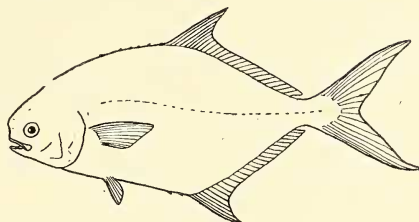
Dorsal soft rays about 25, anal 22 or 23; depth about 2; compressed and silvery.

DISTRIBUTION: Accidental. *Woods Hole*, September 7, 1885, and also a more recent record.

Occurs in the West Indian fauna, rare; accidental northward.

SIZE: Reaches a length of about 10 inches.

160. **Common Pompano**  
*Trachinotus carolinus* (Linnaeus)



Dorsal soft rays about 25, anal 22 or 23; depth  $2\frac{1}{2}$  in adult.

DISTRIBUTION: Not uncommon in late summer and fall, mostly young, July to October 30. *Woods Hole*, young common, adults rare, July till end of September. *Orient*, twice, September 17, 1923, also October 30. *New York*, rather common, August to October 30.

Occurs on the South Atlantic and Gulf coasts of the United States from Cape Cod southward, rare in the West Indies to Brazil.

Concerning this and certain other fishes which reach our region in fair numbers, mostly young in late summer, but are unable to winter so far north, the question arises, do they regularly migrate southward in autumn, or do they become sluggish with the falling sea temperature, to be destroyed by their enemies. The pompano would be capable of such a southward migration, but there is no data to show whether or not it makes one.

The common pompano is a delicious and important food fish of the south, but grown pompanos are rare here, those which reach us annually being, almost without exception, young.

LIFE HISTORY: Adults were fairly common during August 1923 in Sandy Hook Bay, nearly every pound net capturing one or two daily of upwards of 10 inches. Young specimens appeared at an earlier date than usual.

The following tabular matter was compiled from serial collections so made possible:

Date		Average Standard Length
August	2, 1923	28 mm.
"	16, "	58 "
"	23, "	53 "
"	30, "	53 "
October	9, "	85 "
"	19, "	80 "

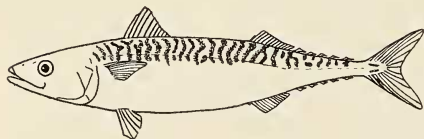
SIZE: Reaches a length of 18 inches. One of the *Orient* specimens measured  $18\frac{1}{4}$  inches total length and weighed 2 pounds.



## MACKERELS

Fishes of large or moderate size, more or less cylindrical, pointed before and behind. Pre-maxillaries not protractile. Caudal very deeply and strongly forked, peduncle narrow, firm, with one or more fleshy keels. Soft dorsal and anal broken up posteriorly into several independent one-rayed finlets.

- |    |   |                      |
|----|---|----------------------|
| a. | Caudal peduncle without median keel, spinous and soft dorsal fins well separated. | <i>Scomber</i>       |
|    | Caudal peduncle with a well developed median keel (see b).                        |                      |
| b. | Body scaleless, excepting about the lateral line and corselet (see c).            |                      |
|    | Body wholly covered with small scales (see d).                                    |                      |
| c. | Spinous and soft dorsal fins well separated.                                      | <i>Auxis</i>         |
|    | Spinous and soft dorsal fins contiguous.  | <i>Gymnosarda</i>    |
| d. | Corselet distinct, body stout (see e).  |                      |
|    | Corselet obscure, body long and compressed.                                       | <i>Scomberomorus</i> |
| e. | Pectoral normal, rather short.  | <i>Thunnus</i>       |
|    | Pectoral very long, ribbon shaped.  | <i>Germo</i>         |



161. **Common Mackerel**  
*Scomber scombrus* Linnaeus

This mackerel has eleven or twelve spines in the first dorsal fin. In the adult the lower parts of the sides are plain silvery. The eye is smaller than in the chub mackerel and there is no conspicuous translucent area on the snout.

**DISTRIBUTION:** Summer resident to the eastward, migrant to the westward. May 3 to early December. *Woods Hole*, common May 10 to December 13. *Orient*, usually common to abundant summer resident, somewhat irregular. Adults rarely common. Very young fish always present June to August; latest date December 14. *New York*, sometimes common, May to July. Young occasional in summer, abundant in the fall, October 21 (1923, L. B. Hunt) to November 19.

Occurs in the North Atlantic northward to Norway and Labrador, and south to Spain and Cape Hatteras.

Grown mackerel approach the coast in spring, and move off shore and into deeper water to disappear in fall, no extensive migration along the coast has been proved for them, such as there is being referable to the configuration of the coast or following the feed. The winter grounds of the American fish are not known, but probably will be found to be at or near the bottom on the continental slope at depths of over 100 fathoms, when in shore during the warmer months the mackerel swims in vast, dense schools, either at the

surface or at times somewhat deeper. Grown fish keep pretty well out, seldom or never entering inclosed bays.

**FOOD:** Consists of small fish, small crustacea (shrimps, copepods, pteropods), squid, fish, etc. At times, probably when larger food fails, mackerel feed by filtering smaller pelagic organisms from the sea water with their gill rakers. Related East Indian species have gill rakers well adapted for this type of feeding, but ours has not, and with it, food taken in this way can be of only secondary importance. Food of the young in Long Island Sound in the fall is mostly *Menidia*; also *Ammodytes*.

**LIFE HISTORY:** Spawns during middle or latter part of June off-shore, but young  $2\frac{1}{2}$  inches long have been recorded June 3 (Woods Hole) and in swarms June 23 (Orient). Massachusetts Bay and the coast of Maine are important spawning grounds.

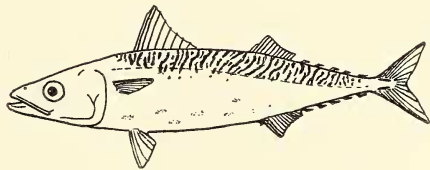
The buoyant non-adhesive eggs of the mackerel are expelled from May to July. They average about  $1\frac{1}{4}$  mm. in diameter and the usual number produced by a female is not far from 41,000. A  $1\frac{1}{8}$  pound fish is recorded as producing 546,000 eggs. These eggs take five days to hatch at a temperature of about  $56^{\circ}$  F., and six more for the yolk sac to be absorbed.

In mackerel fry an inch or so in length separate dorsal and anal finlets are about becoming differentiated, these fins being entire at an earlier age at two inches the young look much like their parents.

From measurements taken in Sandy Hook Bay, fish that appear in June with an average standard length of about 200 mm., reach about 250 ( $9\frac{7}{8}$  inches) in October; but their presence is erratic. Those of about 85 mm. which appear in July apparently reach nearly 200 mm. by the end of October.

**SIZE:** The fully grown mackerel averages about a foot long and weighs about a pound. Occasionally they reach a length of about 20 inches and weigh as much as  $3\frac{1}{2}$  pounds.

162. **Chub Mackerel**  
*Scomber colias* Gmelin



The chub mackerel has nine or ten spines in the first dorsal fin. In the adult the lower part of the side is mottled instead of plain silvery, and vermiculations on the back are usually if not always of finer pattern. The eye is distinctly larger than in the young mackerel of the same size. There is also a translucent area on the snout much more conspicuous than in the young mackerel.

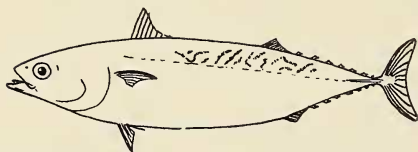
**DISTRIBUTION:** Irregular summer and fall visitor. abundant or rare. Early June to December 12. *Woods Hole*, irregular summer visitant, July 15 to August 25. *Orient*, irregular summer visitant, usually common;

July 5 to December 12. *New York*, irregular visitant, sometimes common; early June to September 27. Normally rare in Sandy Hook Bay and frequently entirely absent. Along the Jersey coast just south of our region, Long Branch to Bradley Beach it is often common in mid-summer, far outnumbering *S. scombrus* in these pound nets. Extremely abundant in Sandy Hook Bay in October 1926.

Occurs widely distributed in the warm and temperate portions of the Atlantic and Pacific oceans, slight differences between Atlantic and Pacific fish being of subspecific rather than specific weight.

This species closely resembles the common mackerel in habits as in appearance. An air bladder is present in the chub mackerel and wanting in the common mackerel, an anatomical difference which would ordinarily be associated with at least generic distinctness (hence the first mentioned species is sometimes given generic rank as *Pneumatophorus colias*) but in our opinion should not be in this case.

SIZE: Reaches a length of about 14 inches.

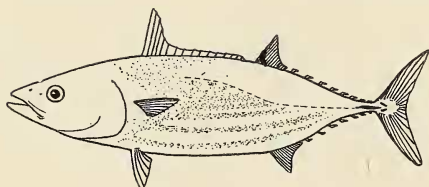


163. **Frigate Mackerel**  
*Auxis thazard* (Lacépède)

DISTRIBUTION: Casual in summer. *Woods Hole*, three or four records (June 29, 1892, two specimens). One collected at Martha's Vineyard about July 1, 1923 (Francis West).

Occurs in all warm seas, occasionally northward to Cape Cod. Said to swim in large schools, erratic as to presence or absence in a given locality.

SIZE: Reaches a length of about one foot, or more.



164. **Ocean Bonito**  
*Gymnosarda pelamis* (Linnaeus)

Dark longitudinal stripes on the lower sides. Body very robust and symmetrical.

DISTRIBUTION: Irregular, numerous off-shore; September to October 10. *Woods Hole*, rarely reported; occasionally occurs as a migrant, to October 10. *New York*, September.

Occurs north to Cape Cod on our coast.

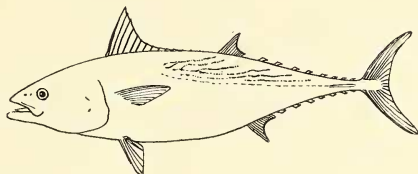
The ocean bonito is one of the pelagic fishes most frequently met with in the broad trade-wind belts of all oceans where it roams in small hungry

schools preying on the flying-fishes, which there are the abundant, conspicuous and characteristic form of fish life.

**SIZE:** Reaches a length of 2 feet or more and weight of about 20 pounds.

### 165. False Albacore

*Gymnosarda alleterata* (Rafinesque)



Black oval blotches on the side of the breast, a vermiculated saddle-like area on the back. Body robust, but caudal portion long and racy.

**DISTRIBUTION:** Not uncommon summer visitant; July to September. *Woods Hole*, irregularly present, not in large numbers, July and August. *New York*, rather common, August 23 through September.

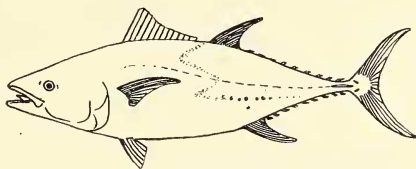
Occurs cosmopolitan in warm seas occasionally northward to Cape Cod.

**FOOD:** Consist of fish (chub mackerel, squid, etc.).

**SIZE:** Reaches a length of 2 or 3 feet and weight of about 20 pounds.

### 166. Tunny

*Thunnus thynnus* (Linnaeus)



**DISTRIBUTION:** Fairly common, irregular summer visitant, late July to October 3. *Woods Hole*, formerly plentiful, but now rare. *Orient*, three records in last 20 years; last record Greenport from the sound, October 3, 1918, 250 pounds. *New York*, sometimes common (late July).

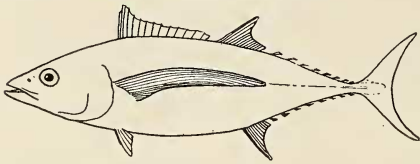
Occurs cosmopolitan in warm seas, north to Newfoundland on our coast.

Fresh from the water, a 27 pound specimen was of great beauty. Above it was dark steel blue, with grey and green. Its cheeks were silver; sides and lower parts greyish silver, highly iridescent in several colors, especially pink; and with vertical bands of longitudinally oval bright spots; these bright bands narrowing and fading out in the dark sides of the back. Dorsals dusky, except the finlets which were yellow more or less margined with black. Anal and its finlets greyish silver; caudal dusky, more or less overlaid with greyish silver at base; ventrals greyish silver outside blackish inside. A specimen 6 or 7 feet long which would have weighed perhaps 500 lbs., in shipment to the New York market from Long Island had dorsal finlets orange yellow edged with black in front and behind, anal finlets the same but black edging very narrow and posterior only; flanks with obscure oval pale linear spots and rings.

**FOOD:** Consists of fish (particularly the menhaden and mackerel) and squid. One of 27 pounds weight, off Block Island, August, contained some

50 individuals of a small herring about 4 inches long, one longer, slenderer Hemiramphid and one small squid.

**SIZE:** An individual 10 feet 4 inches long weighed 710 pounds; said to reach a weight of 1500 pounds.



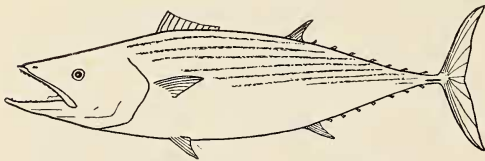
**167. Long-finned Albacore**

*Germo alalunga* (Gmelin)

**DISTRIBUTION:** Casual or accidental. *Woods Hole*, one record, May 21, 1895. *New York*, reports of this fish apparently due to confusion with the false albacore.

Occurs cosmopolitan in warm seas, common in Mediterranean and on the Pacific Coast. Rare on the Atlantic coast north of Florida.

**Size:** Reaches 66¼ pounds (a California record).



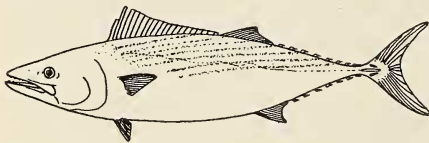
**168. Striped Bonito**

*Sarda velox* Meek and Hildebrand

Conspicuous horizontal black stripes on back; body robust, mouth very large, teeth wide spaced.

**DISTRIBUTION:** Block Island, Aug. 15 and Aug. 22, 1914, a specimen on each date, both taken from schools, not preserved. Drawn as an unknown species by Chas. K. Stillman, 1920. this figure published in Bull. Am. Game Prot. Assn. Jan. 1921. Described as *Sarda velox* from Panama City market by Meek and Hildebrand, 1923.

**SIZE:** Block Island specimens 23½ and 24 inches long weighed 4 to 7 pounds.



**169. Common Bonito**

*Sarda sarda* (Bloch)

Less conspicuous dark stripes on back and sides running obliquely backwards and upward.

**DISTRIBUTION:** Common summer resident. June 15 to November 21. *Woods Hole*, usually common, June to October 1. *Orient*, usually uncommon summer resident, June 15 to November 21. *New York*, common, June to October.



Occurs on both coasts of the Atlantic, north to Casco Bay, Maine, and abundantly to Cape Cod. *Sarda chilensis* from the west coast of America is scarcely more than racially distinct.

Though usually found at the surface it sometimes swims near the bottom, for a small one (12½ inches standard length) taken off the New Jersey shore in early September had 4 partly digested sand launces in its stomach. The bonito is one of the most abundant off-shore summer fishes near New York, with habits similar to those of the bluefish. From its custom of leaping clear in the air and then falling back into the water again, it has been given the name of "skipjack" near New York.

The delicate colors of mackerels change very rapidly when the fish is taken from the water. This species (on the New Jersey shore) is steel or sea green above, the longitudinal stripes dark, lower sides and belly silver. Pectoral and caudal dusky or blackish, anal whitish. First dorsal blackish, the spines paler. Soft dorsal lobe broadly blackish with paler base and pale tip. Sides with alternate broad dark and bright bands, lost almost instantly when the fish were taken from the water. At the same time the silver of the lower parts became dark greyish, and somewhat later the green of the upper parts changed to steel gray or steel blue. The green of the bonito matches the green color of these coastal waters, and it is not unlikely that if taken on blue water the same fish would be blue.

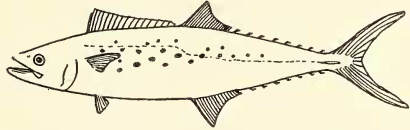
FOOD: Fish and squid.

LIFE HISTORY: Spawns throughout June. Young 5 to 6 inches long, common September 9 (Orient).

SIZE: Reaches about 3 feet (standard length), and 10 or 12 pounds weight.

### 170. Spanish Mackerel

*Scomberomorus maculatus* (Mitchill)



Front of lateral line slanting down rather evenly to lower posterior part; evenly scattered oval bronze spots on back and sides at all ages; dorsal inserted appreciably in advance of anal, depth about 4½.

DISTRIBUTION: Rather common in summer, May 31 to October 5. *Woods Hole*, formerly abundant, now rare, August to October. *Orient*, rare, August 14 to October 5, abundant prior to 1870. *New York*, rather common May 31 to September.

Occurs from Cape Ann (accidental at Monhegan Island, Me.) to Brazil in the Atlantic, and also on the Pacific coast of America, large schools in the Gulf of Mexico and north to the Carolinas, rare or absent about Cuba.

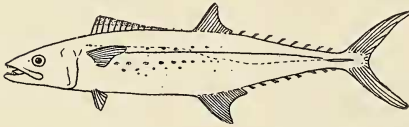
The Spanish mackerel is frequently common near New York in late summer, having at that time much the same habits as the bluefish. Its flesh is unusually rich and sweet, and it is justly famed as a table fish.

Life History. The Spanish mackerel spawns in shore in spring and

summer and apparently at night. The eggs are spherical, highly transparent and range from 1 to  $1\frac{1}{4}$  mm. in diameter. Development is typical and rapid, the eggs hatching in from one to two days. The larvae on hatching measure 2.56 mm. in length. The yolk sac is relatively large and they drift about helplessly. At an age of three days from the time of hatching the larvae have functional mouths and vents, and measure 3.28 mm. Subsequent development is unrecorded.

About New York the spawning season is during September, becoming earlier as one goes south. The eggs are buoyant and non-adhesive. The average number produced by a female is about 20,000. They hatch in about 21 hours at a temperature of  $81^{\circ}$  F.

SIZE: Reaches 9 or 10 pounds weight.



171. **Painted Mackerel**  
*Scomberomorus regalis* (Bloch)

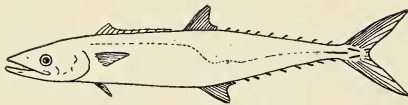
Front of lateral line slanting down rather evenly to lower posterior part; bronze spots on sides at all ages, which are arranged in series or tend to run into longitudinal stripes; dorsal inserted over anal, the two fins more fully scaled than in *maculatus*; depth  $4\frac{1}{2}$  to 5.

DISTRIBUTION: Uncommon to the eastward, rare recently. *Woods Hole*, about as common as *S. cavalla*, few taken lately. *Orient*, rare, September 23 and October 2 are recent records. *New York*, unknown.

Occurs from Cape Cod to Brazil, generally scarce, common about the Florida Keys and abundant near Cuba.

FOOD: Consists of small fish.

SIZE: Reaches a length of 4 or 5 feet and weight of 20 to 35 pounds.



172. **King Mackerel**  
*Scomberomorus cavalla* (Cuvier and Valenciennes)

Front of lateral line dropping abruptly to lower posterior part, the anterior portion of which is strongly undulated; immaculate, silvery, except for the young, which have spots; depth 6.

DISTRIBUTION: Summer visitor. Formerly common or abundant to the eastward, now rare. July 1 to fall. *Woods Hole*, formerly abundant, now rare, July 1 to late fall. *Orient*, now rare, recent records August 17, 1910 (4 taken); September 21 to 23, 1918. *New York*, unknown.

Occurs in the warm parts of the North Atlantic, south to Africa and Brazil, abundant about the West Indies and Florida Keys.

FOOD: Consist of fish and squid.

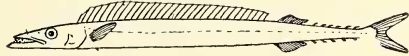
SIZE: Reaches a length of 5 feet and weight of 100 pounds.

## ESCOLARS

Diverse fishes of the open sea rare on continental coasts, forming more or less of a transition from the mackerels to deep water forms, of which series the cutlass-fish, again a shore species, represents the terminal development. Our single species (*Gempylus*) has large eye, strong teeth like a barracuda; an elongate compressed body, suggestive of a needlefish, and mackerel-like finlets.

## 173. Snake Mackerel

*Gempylus serpens* Cuvier and Valenciennes



**DISTRIBUTION:** Accidental, once, a large specimen found cast up on the sea beach near the Napeague Coast Guard Station, Long Island, by George H. Mulford, November 16, 1923. It measured 44 inches total length.

Occurs in warm seas, cosmopolitan.

The depths at which the snake mackerel swims are uncertain, probably usually considerable in the case of the adult, though it likely sometimes approaches the surface. We have seen a young one in the collection of the American Museum of Natural History which was being carried by a white tern when taken near Ducie Island in the Central Pacific. It is likely that the species is a surface fish when only a few inches long, a member of a little known off-shore surface fauna.

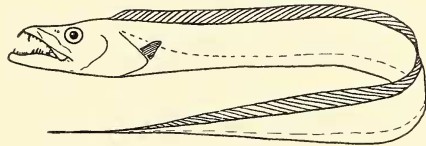
**SIZE:** Reaches a total length of 44 inches, as above.

## CUTLASS FISHES

Elongate, band-shaped, silvery fishes with large mouth and prominent, pointed teeth, the tail ending in a thread.

## 174. Cutlass-fish

*Trichiurus lepturus* Linnaeus



**DISTRIBUTION:** Rare in summer, June to October. *Woods Hole*, rare but rather regular, June to October. *Orient*, casual, July 16 and August 27. *New York*, rare, July and August.

Occurs in warm seas, chiefly of the western Atlantic, but also recorded in Lower California; north to Virginia, and straggling to Massachusetts Bay. Not infrequent on sandy ocean shores.

**SIZE:** One of 19 inches, total length, from *Orient*, the largest taken locally. Said to reach a length of about 5 feet.

## SPEARFISHES

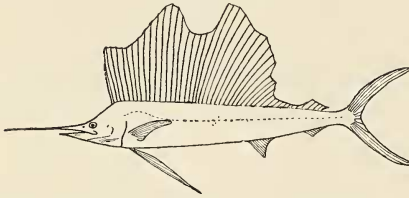
Elongate fishes of large size, with strong, deeply forked caudal and narrow peduncle. The upper jaw ending in a long, cylindrical, bony spear.

Dorsal very high, undivided.

Dorsal low, divided in the adult.

*Istiophorus*

*Tetrapterus*



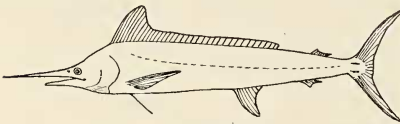
## 175. Sailfish

*Istiophorus nigricans* (Lacépède)

**DISTRIBUTION:** Casual, summer and early fall, 6 or 7 records. *Woods Hole*, casual, a half dozen in early fall during 25 years. *New York*, one record, August.

Occurs in the warmer parts of the Atlantic, north to Florida and France, common in southern Florida.

**SIZE:** Six feet or more long when adult. 8 feet 4 inches in total length with a weight of 95 pounds the record.



## 176. Spearfish

*Tetrapterus imperator* (Bloch and Schneider)

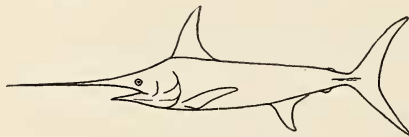
**DISTRIBUTION:** Generally rare in summer to the east, unknown to the west, July and August. One taken about July 1, 1890, Westhampton, the only Long Island record. *Woods Hole*, generally rare, common in July and August from 1885 to 1890.

Occurs in the warmer parts of the Atlantic, southern Europe, West Indies, occasionally northward to Cape Cod, or Maine according to fishermen.

**SIZE:** Reaches an ordinary total length of 7 feet, and is said to reach 26 feet!

## SWORD-FISHES

Similar to the spear-fishes, but the prolongation of the upper jaw depressed, a flat blade like that of a sword.



## 177. Swordfish

*Xiphias gladius* Linnaeus

**DISTRIBUTION:** Common to the eastward, July 1 to October, rare to the westward, June. *Woods Hole*, common in July and August, and present July 1 to October. *Orient*, rare, a record July 1. *New York*, rare, June.

Occurs cosmopolitan in warm seas, in the Atlantic rather common in southern Europe and between Cuba and Cape Breton.

Deep-water species sometimes found in their stomachs prove that they feed at a considerable depth. They have been described as rising through schools of surface fishes striking right and left with their swords, and then turning to pick up the fishes they have thus disabled, but thoroughly satisfactory detailed observations of this habit are hard to find.

On calm days swordfish are to be found scattered, lying quietly or swimming sluggishly at the surface with top of dorsal and caudal fin out of water. Prof. Ulric Dahlgren believes that they have for the most part been feeding at considerable depths and come to the surface to rid themselves of the troublesome lamprey. They are taken with the harpoon and will very rarely strike at a baited hook, probably having somewhat different feeding habits here from in California waters where not infrequently captured with rod and reel.

Swordfish are active and powerful, and when harpooned at times drive their sword into a vessel or through a small boat. There are doubtless authentic cases of their sword being driven into a vessel at sea, though possibly most such refer to the spearfish (*Tetrapterus*) seemingly from malice, such incidents may yet be accidental.

One taken off Block Island in December at a depth of 80 fathoms on a trawl line set for tilefish weighed 410 pounds. (C. H. Townsend in the Bull. N. Y. Zool. Soc., July, 1923.) With the approach of winter they probably move off into the depths rather than migrating southward.

**FOOD:** The food of the swordfish consists of fish (mackerel, menhaden, bluefish, silverhake, butterfish, herring, etc.) and squid. In one specimen 11 hake (1 to 2 feet long) and one menhaden were found; in another 9 menhaden.

**LIFE HISTORY:** Supposed to spawn in the Mediterranean in summer, but does not do so off our coast at that season. Young fry have been found in the open Atlantic between 20° and 39° north. Swordfish have a larval stage different from the adult, with long high dorsal and anal fin, jaws equal and toothed, skin set with spinules. At half a pound weight the adult form has been assumed.

**SIZE:** The maximum weight of the swordfish is 600 to 800 pounds, though it is usually smaller, 400 pounds or less.

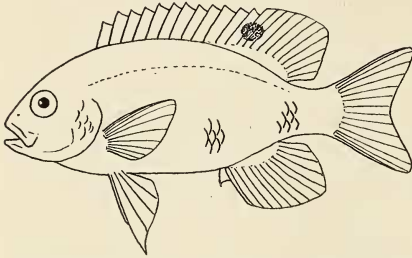
### POMACENTRIDS

Small, spiny-finned, more or less short and deep bodied, usually highly colored, active shore fishes characteristic of tropical coral reefs. The dorsal similar to that of the wrasses, caudal moderately forked, scales moderate or rather large, lateral line wanting, mouth and teeth small, nostril single.



Preopercle sharply serrate. No black cross-bands.  
Preopercle not serrate. Sides with black cross-bands.

*Eupomacentrus*  
*Abudefduf*



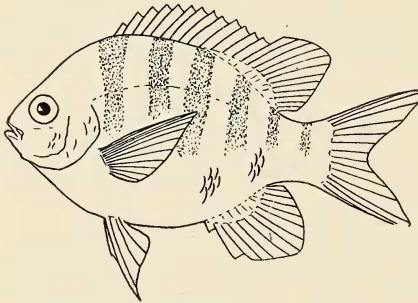
178. **Beau-gregory**  
*Eupomacentrus leucostictus* (Müller  
and Troschel)

**DISTRIBUTION:** Casual to the eastward in summer and fall, August 30 to October 4, 1899, 9 specimens, Katama Bay.

Occurs in the West Indian fauna, north to Florida.

‡ Frequents rocks and reefs in clear, rather deep water when adult, the young abundant in shallow rocky tide pools.

**Size:** Reaches a length of about 6 inches.



179. **Sergeant Fish**  
*Abudefduf saxatilis* (Linnaeus)

**Distribution:** Accidental, once, Newport.

Occurs on both Atlantic and Pacific coasts of tropical America, from Florida to Uruguay in the Atlantic. Abundant in tide pools and about coral reefs everywhere. As this species is known to spawn in fall in Florida, its young would be of drifting age in the winter when they could not survive in northern latitudes, very likely the reason they do not occur in our region.

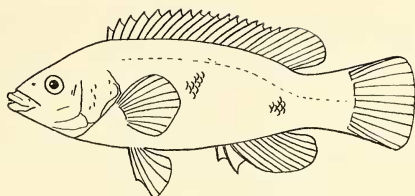
**Size:** Reaches a length of 6 inches.

## WRASSES

Small, or moderate sized, shore fishes with large or small smooth scales. The dorsal of spines in front, soft-rayed behind; the spinous portion decidedly longer than the soft part. Caudal usually squarish, pectorals rounded. Large strong teeth in front of the small, thick-lipped mouth.

Preopercle serrate. Scales moderate.  
Preopercle entire. Scales small.

*Tautoglabrus*  
*Tautoga*

180. **Cunner***Tautoglabrus adspersus* (Walbaum)

**DISTRIBUTION:** Permanent resident, abundant to the eastward. *Woods Hole*, abundant permanent resident sometimes destroyed in great numbers during severe winters by heavy ice. *Orient*, abundant on rocky bottom in summer, very rare in winter; occasionally taken from mud; becomes common in May in the Sound and rare late in November. *New York*, common locally, where suitable ground occurs, resident.

Occurs from Labrador to Sandy Hook, New Jersey, and casually the mouth of Chesapeake Bay. Frequents rocky bits of bottom at various depths, and is abundant under wharves and around piers. Said to take refuge among eel-grass in winter. Descends to depths of 25 and 35 fathoms.

When swimming slowly, the pectoral fins of the cunner are often the propelling power, the body gliding forward smoothly and rather swiftly. This is a sort of locomotion rare among fishes and characteristic of the wrasse family, of which the cunner is the most northern representative on our coast.

It would be an excellent food fish except that it does not reach a large enough size. In consequence, where abundant, it is a nuisance to the fisherman. It is sometimes called nibbler. Northward along the New England coast it is known as cunner. Here it reaches a somewhat greater size and is largely taken in traps and extensively used for food. Near New York it is known as bergall.

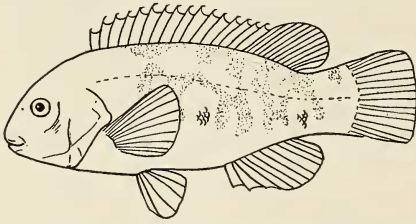
Practically omnivorous, feeding on sea-weed, hydroids, bryozoa, tunicates, annelids, small crustacea (*Caprella*, shrimps, amphipods, crabs, isopods), univalve molluscs, small fishes (silversides, sticklebacks, pipefish, etc.), and teleost eggs.

**LIFE HISTORY:** Young taken in tow net from June to October, most abundantly in June and July. This, with the exception of the tautog, the only labrid breeding within our range, likewise spawns chiefly in June and early July and also in moderately deep water off shore. The eggs are transparent, buoyant and spherical and range from 0.75 to 0.85 mm. in diameter. They are distinguishable from the ova of the tautog only by virtue of their smaller size. They incubate in about 40 hours at a temperature of 72° F. The newly hatched fish measures about 2.1 mm. At three days after hatching the yolk is gone and the larvae have a length of about 2.9 mm. After the length of 10 mm. is reached the adult characters are assumed rapidly.

In New York Bay during September young fish were taken in dredges on oyster beds in a depth of 10 to 14 feet. It is inferred that the rate of growth

is about 2 mm. per week as the fish taken near the first of the month averaged about 18 mm. whilst those taken near the last averaged about 26 mm. Maturity seems to be reached in about the third year.

**SIZE:** The cunner is ordinarily less than a foot long and weighs under a pound. In this latitude it is generally much smaller, the large ones being more northern in distribution. In the Gulf of Maine they are occasionally taken up to 15 inches long and weighing as much as 2½ pounds.



181. **Tautog**  
*Tautoga onitis* (Linnaeus)

**DISTRIBUTION:** Common permanent resident. *Woods Hole*, common permanent resident, numbers killed by ice in severest winters. *Orient*, resident, abundant April to December 1; rarely seen in winter except in hibernation, and these rarely reaching 2 pounds in weight. A heavy migration in October and November. *New York*, common permanent resident.

Occurs from New Brunswick to Charleston, S. C., most abundant between Cape Cod and the Delaware Capes. Frequents rocks and seaweed in rather shallow water.

The tautog is a succulent morsel at all ages, and its ability to hide away among rock and weed gives it only a relative immunity from being eaten. We have seen a small one taken from the stomach of the red-throated loon. Winters in a more or less sluggish condition in slightly deeper water.

**FOOD:** Eats a great variety of crabs and shell-fish. Is said even to eat sessile barnacles of considerable size. The young eat seaweed, small crustacea and mollusks, and annelids.

**LIFE HISTORY:** Young taken in tow in June, July and August, and abundant hiding in sea lettuce (which their green color matches) in shallow bays in early fall.

The tautog is a summer spawner, the season being at its height in June and running over into July. The eggs are spherical, transparent and vary from 0.9 to 1.0 mm. in diameter. They float in sea-water although the yolk contains no oil globule. Incubation takes from 42 to 45 hours at a temperature of 72° F. which is a higher temperature than ordinarily attained on the spawning grounds. The newly hatched larvae measure about 2.2 mm. As in many pelagic larvae of diverse families, the posterior portion of the fish is free from pigment. Growth is rapid; in four days the larval tautog increases its length to about 3.3 mm. By the time a length of 30 mm. is reached the diagnostic characters of the adult have appeared, although fish of this size are somewhat more slender than the older ones.

In Sandy Hook and Jamaica Bays in fall young from 2 to 2½ inches standard length are common. Maturity probably is reached in about three years and spawning no doubt takes place in rather deep water as these fish are absent from shoal waters during the summer months.

**SIZE:** The tautog, or blackfish as it is called to the westward, grows much larger than the cunner and is one of the most valuable food fishes of the Atlantic coast, being much sought after by local anglers. The largest blackfish on record was taken near New York in 1876. It was 36½ inches long and weighed 22½ pounds. This size is, of course, very exceptional. Anything over 10 pounds is very large for the species. Largest Orient specimen 23 inches total length, 13¼ pounds.

### PARROT FISHES

Bright colored tropical fishes of moderate size, with large smooth scales. They resemble the wrasses, but have teeth fused into a strong nipper-like beak.

Gill-membranes broadly joined to the isthmus. Dorsal spines stiff.

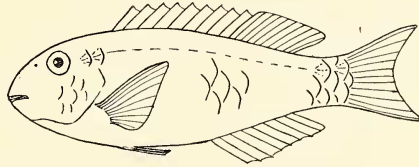
*Sparisoma*

Gill-membranes forming a fold across the isthmus. Teeth whitish or rosy in color.

*Scarus*<sup>10</sup>

#### 182. **Mud Parrotfish**

*Sparisoma flavescens* (Bloch and Schneider)



**DISTRIBUTION:** Accidental, one record, November 13, 1900, picked up on shore of Buzzard's Bay.

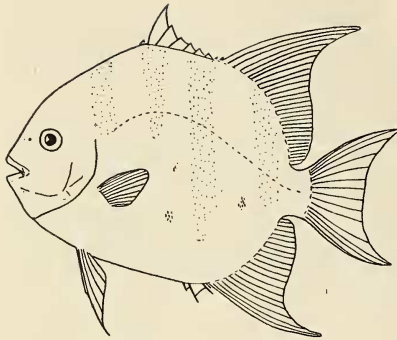
Occurs in the West Indian fauna, common. Key West to Rio Janeiro.

**SIZE:** Rarely exceeds one foot in length.

### SPADE-FISHES

Deep, compressed fishes of moderate size with small but rough scales. Spiny rayed back fin separate from the soft-rayed fin behind it, which is high and pointed and resembles the anal. Both these soft-rayed vertical fins densely scaled.

<sup>10</sup> The St. Croix parrot fish, *Scarus croicensis*, is recorded as accidental, Katama Bay, October 20, 1900, 2 specimens. Their identity with this, one of the less common of the numerous West Indian parrot fish, may be questioned.



183. **Spadefish**  
*Chaetodipterus faber* (Broussonet)

**DISTRIBUTION:** Rare in late summer and early fall, June 17 to October 6. *Woods Hole*, rare, August to October. *Orient*, rare, June 17, 1912, Gardiner's Bay, three individuals taken October 2 to 6, 1916. *New York*, occasional, summer to October 3 (1924, Sandy Hook Bay).

Occurs from Cape Cod to Rio Janeiro.

**LIFE HISTORY:** In Virginia this species spawns from June to August. The eggs are buoyant, non-adhesive, and average about  $1\frac{1}{4}$  mm. in diameter. They hatch in 24 hours at a temperature of  $78^{\circ}$  F. In North Carolina the young fish reach a length of 3 inches by the latter part of August.

**SIZE:** Reaches 2 to 3 feet in length; one taken locally measured 16 inches in total length and weighed  $3\frac{3}{4}$  pounds (*Orient*).

#### BUTTERFLY FISHES

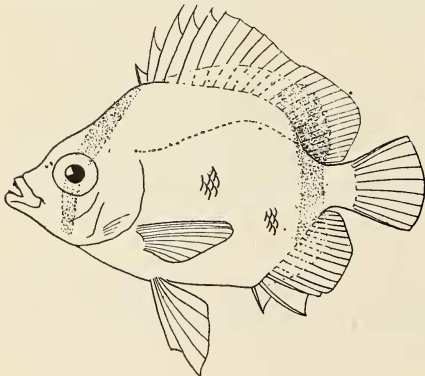
Small or moderately large, deep bodied, compressed fishes with a single back fin, the anterior spinous part closely united to the posterior of soft rays. Mouth small, teeth fine and brush-like. The soft vertical fins densely scaled.

Preopercle unarmed.

*Chaetodon*

Preopercle armed at its angle with a long, strong spine.

*Pomacanthus*



184. **Common Butterfly-fish**  
*Chaetodon ocellatus* Bloch

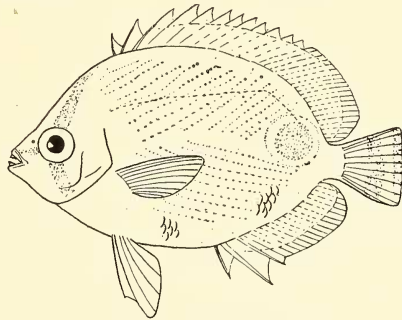


Series of scales below axis of body, running obliquely upward and backward, the lowest becoming more or less horizontal. Two bold black vertical stripes, one through eye, the other connecting the bases of the soft vertical fins.

**DISTRIBUTION:** Uncommon, August to November. *Woods Hole*, a few each year and occasionally common, August to November. *New York*, occasional, September 21 (1925, Jamaica Bay, 10 mm. standard length), October 7 (1923, Long Beach, Elizabeth T. Janvrin), November 6 (1924, Point'O Woods, L. I., Katherine Wager Smith, found lying on seaweed on the bay shore front). *Sandy Hook Bay*, September 22, 1926,  $\frac{1}{2}$  inch standard length.

Occurs in the West Indian fauna, the young straying northward in the Gulf Stream to New Jersey and Rhode Island. Seined among eelgrass at Woods Hole. Driven ashore through the surf at Long Beach by a southerly gale in October.

**SIZE:** Reaches a length of about 8 inches.



**185. Four-eyed Butterfly-fish**

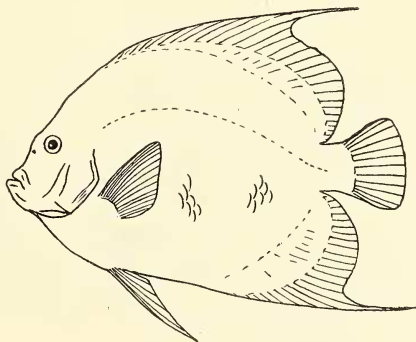
*Chaetodon capistratus* Linnaeus

Series of scales below axis of body extending downward and backward, forming an angle with those above. A black vertical stripe through eye, and large ocellus on hind part of body.

**DISTRIBUTION:** Usually rare, occasionally in some numbers to the eastward, in late summer and fall. *Woods Hole*, August to October.

Occurs in the West Indian fauna.

**SIZE:** Reaches a length of 6 inches.



**186. Black Angel Fish**

*Pomacanthus arcuatus* (Linnaeus)

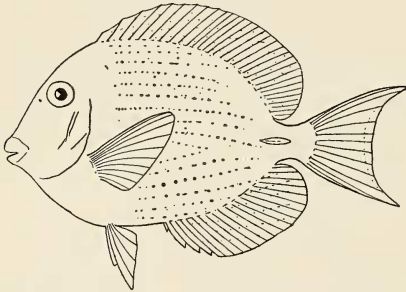
**DISTRIBUTION:** Accidental, New York.

Occurs in the West Indian fauna south to Bahia, occasionally north to New Jersey.

**SIZE:** Reaches  $1\frac{1}{2}$  to 2 feet in length.

### SURGEON FISHES

Small-mouthed, deep-bodied, compressed fishes. Spines and rays of the long back fin little differentiated. Scales minute. Teeth small, narrow, incisor-like. An erectile spine on the side of the peduncle.



#### 187. Blue Surgeon Fish

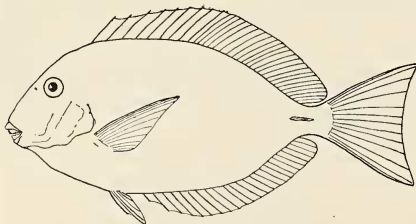
*Teuthis caeruleus* (Bloch and Schneider)

Deep-bodied, depth  $1\frac{1}{2}$  in length, the adult more or less deep blue in color.

**DISTRIBUTION:** Young rare to the eastward in late summer and fall, August to October.

Occurs in the West Indian fauna, from the Florida Keys and Bermuda to Bahia, casually northward.

**SIZE:** Reaches a length of about one foot.



#### 188. Common Surgeon Fish

*Teuthis hepatus* Linnaeus

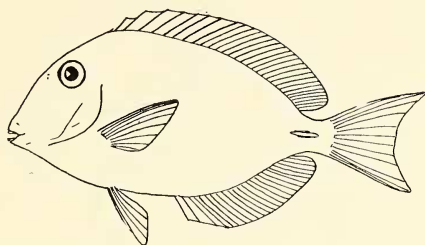
Depth about 2 in length; caudal simply lunate, color more or less olivaceous, usually with distinct cross-bars.

**DISTRIBUTION:** Young rare to the eastward in late summer and fall, accidental to the westward, August to October. *Woods Hole*, recorded from August to October. *New York*, accidental, October.

Occurs in the West Indian fauna from Florida to Bahia, casually northward.

**SIZE:** Reaches a length of about 10 inches.

189. **Ocean Surgeon Fish**  
*Teuthis bahianus* (Castelnau)



Depth about 2 in length; caudal more deeply emarginate, upper lobe produced in a filament in the adult; color more or less olivaceous, usually a paler area at the base of the caudal fin.

**DISTRIBUTION:** Young rare to the eastward in late summer and fall, August to October. *Woods Hole*, recorded from August to October.

Occurs in the West Indian fauna from the Florida Keys to Bahia, casually northward.

**SIZE:** Reaches a length of one foot.

#### TRIGGER-FISHES

Sluggish, compressed fishes with small mouths, the teeth more or less fused and nipper-like. Skin leathery, but with evident scales. First back fin of three spines.

Gill opening with a number of large bony scales behind it.

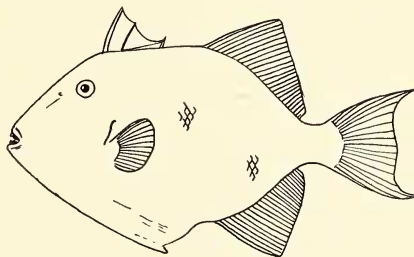
*Balistes*

Gill opening with only ordinary scales behind it.

*Canthidermis*

190. **Trigger-fish**

*Balistes carolinensis* Gmelin<sup>11</sup>



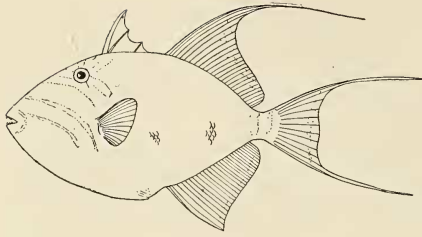
Cheek without blue bands; body with few blue spots or none.

**DISTRIBUTION:** Rare in late summer and fall, July to November 11. *Woods Hole*, very rare, fall. *Orient*, rare, September 1 to November 11. *New York*, rare, July to October 17.

Occurs in the tropical and sub-tropical parts of the Atlantic on both coasts, occasional northward in the Gulf Stream, casually to Nova Scotia.

**SIZE:** Reaches 14 inches total length (*Orient*).

<sup>11</sup> The spotted trigger-fish, *Balistes forcipatus*, found on the west coast of Africa and about neighboring islands, has been reported as accidental at Newport, but the record needs confirmation.



191. Queen Trigger-fish

*Balistes vetula* Linnaeus

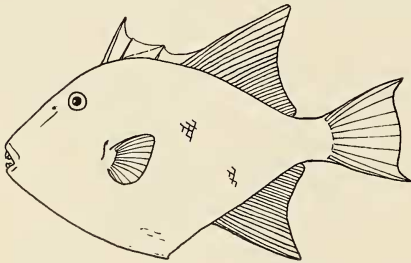
Cheek with two broad, curved blue bands, dorsal and caudal in adult with filamentous angles.

**DISTRIBUTION:** Rare to the eastward in summer and fall, September, not recorded to the westward. *Woods Hole*, rare, summer and fall, September.

Occurs in the warmer parts of the Atlantic, common in the West Indies, occasionally north in the Gulf Stream.

**FOOD:** Amphipods, copepods and seaweed recorded as food.

**SIZE:** Reaches a length of about 15 inches without the caudal filaments.



192. Ocean Trigger-fish

*Canthidermis sobaco* (Poey)

**DISTRIBUTION:** One record, Vineyard Sound, off Great Harbor; one specimen taken in floating gulfweed, July 24, 1897.

Occurs in the West Indian fauna, rarely north in the Gulf Stream.

**SIZE:** Reaches a length of 2 feet.

#### FILEFISHES

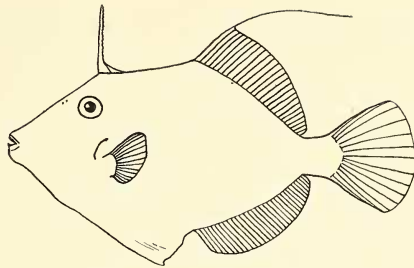
Sluggish, compressed fishes with small mouths, the teeth more or less fused and nipper-like. Skin leathery, scales not evident. First back fin of a single spine.

Pubic bone with a small spine at its end.

*Monacanthus*

Pubic bone without spine at its end.

*Alutera*

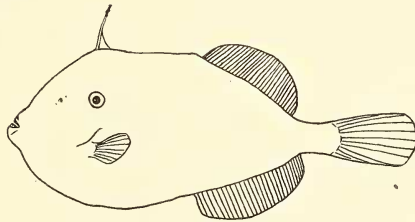
193. **Common Filefish***Monacanthus hispidus* (Linnaeus)

**DISTRIBUTION:** Not uncommon in late summer and fall, mostly young, sometimes common to the eastward, July to November 22. *Woods Hole*, July to November, in varying numbers, sometimes very common, young only. *Orient*, September 10 to November 22. *New York*, rather common, August to November, most frequent from mid-September to mid-October.

Occurs from Cape Cod (casually Nova Scotia) to Cuba, abundant on the Florida coast. This fish appears in fall with *Alutera* in Sandy Hook Bay but is less common.  $3\frac{1}{4}$  inches is about the average standard length.

**LIFE HISTORY:** Young occur in drifting gulfweed, eel-grass, etc.

**SIZE:** Reaches a length of 10 inches.

194. **Orange Filefish***Alutera schoepfii* (Walbaum)<sup>12</sup>

Dorsal rays about 36, anal about 38.

**DISTRIBUTION:** Rather common summer and fall, May to November 14. *Woods Hole*, rather common, July to November 10. *Orient*, rare, only stray individuals taken, June 19 to November 14. *New York*, rather common May to November.

Occurs from Cape Cod (casually Portland, Me.) to Florida and Texas. Frequents sandy shores, especially near eel-grass.

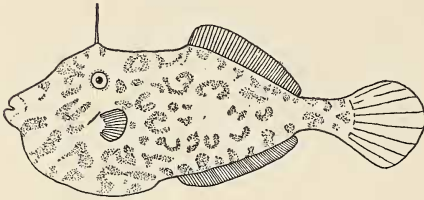
**FOOD:** algae, hydroids, one specimen in August was found to have eaten a large quantity of *Pennaria*.

Common in Sandy Hook Bay in October, mostly young examples. A dozen taken on October 18 showed a mode of  $7\frac{1}{2}$  inches in standard lengths with a maximum of  $9\frac{3}{4}$  inches and a minimum of  $4\frac{3}{4}$  inches.

<sup>12</sup> The scrawled filefish, *Alutera scripta* with dorsal rays about 46, anal about 50, caudal fin elongate with rounded angles, sides marked with dark spots and irregular blue spots and lines, is recorded from New York on the authority of Eugene Smith. Its occurrence in our region needs confirmation.



**SIZE:** Reaches a length of 24 inches; 21 inches total length, 2½ pounds weight, the largest recorded from Orient.



**195. Unicorn Filefish**  
*Alutera monoceros* (Osbeck)

Dorsal rays about 46, anal about 50. Caudal fin short, sub-truncate, with acute angles. Coloration uniform.

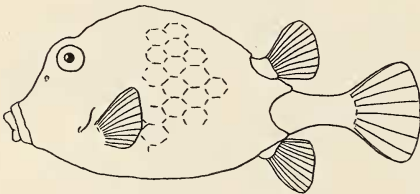
**DISTRIBUTION:** Accidental, 2 records, *Woods Hole*, August 22, 1898, August 1, 1899.

Occurs in the West Indian fauna and appears to be cosmopolitan in warm seas.

**SIZE:** Reaches a length of 1 or 2 feet.

#### BOX FISHES

Sluggish, small-mouthed fishes. The teeth more or less fused and nipper-like. The body encased in a hard shell, triangular (beechnut-shaped) in our species.



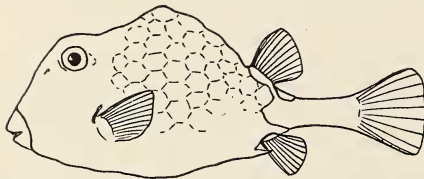
**196. Trunkfish**  
*Lactophrys triqueter* (Linnaeus)

Shell with no spines anywhere.

**DISTRIBUTION:** Several taken at *Woods Hole*, sometimes confused with *L. trigonus*.

Occurs in the West Indian fauna, north to Florida and Bermuda.

**SIZE:** Reaches a length of 10<sup>3</sup>/<sub>5</sub> inches.



**197. Common Trunkfish**  
*Lactophrys trigonus* (Linnaeus)

Shell with distinct spines on the ventral ridges behind, none on the forehead. Shell closed behind the back fin. Body mottled with paler.

**DISTRIBUTION:** Rare in late summer and fall, more common to the eastward, July to October. *Woods Hole*, young, (maximum one inch long) not uncommon, July to October. *New York*, occasional, August to October.

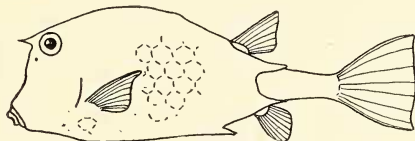
Occurs in the West Indian fauna, common as far north as the Florida Keys and Bermuda, occasionally northward in the Gulf Stream to Massachusetts.

**LIFE HISTORY:** Young occur under Gulf weed or among eel-grass at Woods Hole. When  $\frac{1}{2}$  inch or less in size they are squarish or orbicular in outline, (due to the slight development of the ridge in the center of the back, and the comparatively great development of the two ridges at its sides) suggesting the allied Ostracion, which does not occur in America. We have to hand one about  $\frac{1}{2}$  inch long picked up at Point O'Woods, September 27, wherein the ventral spines are blunt, little developed, color yellowish with dark specks.

**SIZE:** Reaches a length of about 9 inches.

### 198. Cowfish

*Lactophrys tricornis* (Linnaeus)



Shell with spines on the ventral ridges behind, also one on either side of the forehead.

**DISTRIBUTION:** Rare at Woods Hole. September to November 6. *New York*, accidental, Fire Island Beach, about November 1, 1919.

Occurs in the tropical parts of the Atlantic, Carolina (and as a straggler Massachusetts) to Brazil, occasionally west to Galveston, east to Guinea and the Cape of Good Hope.

**SIZE:** Reaches a length of one foot or more.

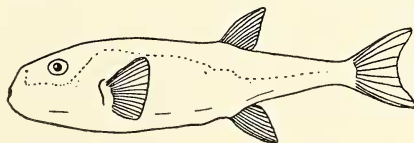
## SWELLFISHES

Small, sluggish, small-mouthed fishes, the teeth more or less fused and nipper-like. Body rotund and more or less finely prickly. Skin loose, the fish capable of swelling to a spherical form by taking in air or water.

Dorsal and anal fins more or less falcate, of 12 to 15 rays. *Lagocephalus*  
Dorsal and anal fins rounded, of 6 to 8 rays. *Tetraodon*

### 199. Smooth Swellfish

*Lagocephalus laevigatus* (Linnaeus)



**DISTRIBUTION:** Rare in fall, September 15 to November 5. *Woods Hole*, not common, mostly September and October. *Orient*, rare, November 1 to November 5. *New York*, rare, September 15 to October.

Occurs from Cape Cod to Brazil, uncommon north of Cape Hatteras.

SIZE: Reaches a length of 2 feet.



**200. Southern Swellfish**

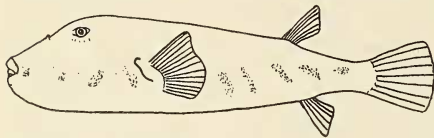
*Tetraodon spengleri* Bloch

Narrow and slightly concave between the eyes. Sides usually with small flaps. White of lower surfaces marked off by a row of conspicuous roundish black blotches.

DISTRIBUTION: Casual, *Woods Hole*, September and October.

Occurs in the West Indian fauna from Texas and Florida to Rio Janeiro, and in the Madeiras and Canaries, casually north to *Woods Hole*.

SIZE: Reaches a length of one foot.



**201. Common Swellfish**

*Tetraodon maculatus* Bloch and  
Schneider

Narrow and slightly concave between the eyes. No dermal flaps. Rows of blackish blotches on the side less conspicuous, irregular more or less vertical bars.

DISTRIBUTION: Abundant in summer and fall, May 16 to December 15. *Woods Hole*, abundant, May 20 to cold weather. *Orient*, May 16 to December 15. *New York*, abundant, May to November.

Occurs from Casco Bay casually, Cape Ann rarely and Cape Cod abundantly to Florida.

Puffers are fishes of sandy shores and spend much of their time poking around near to the bottom, close to or often amid sea wrack, in an effort to pick up mollusks and crustaceans which together form the bulk of their food. It is not uncommon to find puffers half buried in the sand, thus resting partly protected. In working into position and covering themselves they so plow up the bottom that two ridges diverging backwardly from their snout become prominent in the sand, thus giving away their place of concealment, if such it is.

Their most striking habit is of course their method of defense, i.e., inflation, to which habit their common name refers. The mere sight of a predacious fish or enemy will often cause them to engulf enough water to become nearly spherical, although usually they attempt to flee and resort only to inflation at times of great and immediate mortal danger. Their near relative from Florida (*Tetraodon harperi*) Nichols<sup>13</sup> in the aquarium,

<sup>13</sup> *Tetraodon harperi*, described from Cape Sable, Fla., resembles *T. maculatus* closely, and specimens recorded as the latter from the Carolinas southward should be examined with reference to the former species. West Indian *T. spengleri* looks quite different from either.

at least, frequently inflates simply on sight of a dip net thrust into the tank. Sometimes in the aquarium our common puffer inflates himself for no apparent reason at all—perhaps a matter of exercise.

In feeding on small crabs the puffers go to some trouble to take the first bite from the front and use care to so direct it that it severs the nervous ganglion. This at once paralyzes the crustacean and renders it a simple matter to tear it apart. Naturally the claws of the crab are so flexed as to protect this important and vulnerable spot to the greatest extent possible. This implies that the puffers must pay for their feast by receiving many little nips about the mouth. This seems to bother them but little unless the crab is of such a size that the eyes of the puffer can be reached. If it so happens that the 'reach' of the crab is equal to or greater than the distance from the mouth to the eye of the puffer the crustacean is never attacked in the manner described above, but instead many little sallies are made at other less protected points. A large blue crab may be surrounded by a half dozen or so puffers. In a short time it is so weakened and confused by their concerted attacks and constant harrying that it is relatively easy for one of them to cripple it so that the final closing in and feasting may be consummated.

**FOOD:** Consists of various crabs and other crustacea, also bivalve and univalve mollusks, annelids, seaweed, etc.

An interesting letter received from Walter B. Savary of Wareham, Mass.; dated October, 1924, doubtless refers to this species, although the colloquial name he uses for it is unusual. He writes: "Is it commonly known that the small drum fish so plentiful on our flats in summer can inflate himself out of the talons of a fish hawk? I watched a hawk fishing for drums on Little Harbor Flats in not over two feet of water. With my field glass I could see the whole performance; he was not far off at any time and I could see whenever he caught a fish, which, was by no means every time. When he did get one he would rise about four feet before the drum got his inflation started. This he seemed to do quickly and effectively for, he was out of the claws before the hawk had time to give that shake that always follows a plunge. I watched him strike, and lose four fish all in the same manner."

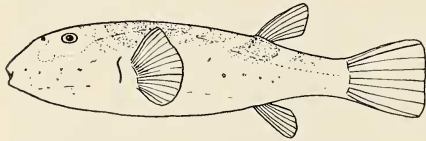
**LIFE HISTORY:** Spawns from June 1 to 10; small young abound in summer, taken in the tow from June to August, chiefly in July (Woods Hole). Young of 1 to 3 inches (total) frequently taken as late as November and first of December, (Orient). June 1 to July 15, many adults nearly or quite ripe; later, July 27 to October 31, all adults apparently spent, young from about 1 to 5 inches standard length taken (Sandy Hook Bay).

The puffers' spawning season is a rather protracted one, covering, as it does, the entire summer. Ripe females in the vicinity of New York Bay have been seen as early as June 7 whilst an occasional laggard may still be found ripe in late August or early September in the same locality. The eggs are heavy adhesive spheres of a light amber color varying from .85 to .91 mm. in diameter. At a temperature of about 67° F. they hatch in

about  $4\frac{1}{2}$  days into active larvae, 2.41 mm. long, of striking coloration; orange and black chromatophores forming a variegated pattern. The tip of the tail is colorless and nearly invisible. A chrome yellow spot marks the posterior ending of the chromatophores, which is abrupt. At the end of 10 days the yolk sac is nearly gone, the mouth is functioning and the length has increased to 2.65 mm. The pectorals are well developed, whilst the iris presents a startling metallic green lustre. The post larvae resemble the adults closely but are rather more chunky and have the eye much larger, and lack the color pattern of the latter. At this stage the ability to inflate exceeds even that of the adult.

We have scant knowledge of the rate of growth and the excessive overlapping of the year classes is so great that it suggests even a longer spawning season than is known to exist. In July and August examples from 20 to 70 mm. are often taken. Doubtless most of these are yearlings, the large ones from early spawnings and the small ones from late. Allowing for a proportionate decrease in the rate of growth it should take them about three years to reach maturity. Possibly the males mature a year earlier than the females as some very small ripe males have been seen.

**SIZE:** Reaches a length of 6 to 10 inches. The adults in Sandy Hook bay average about  $7\frac{1}{8}$  inches standard length in June, we have one record of a fish  $8\frac{3}{4}$  inches.



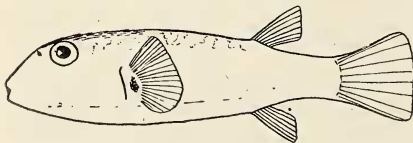
202. **West Indian Swellfish**  
*Tetraodon testudineus* Linnaeus

Broad and flattish between the eyes. Back and sides marked with more or less irregular narrow pale curved stripes which tend to be concentric.

**DISTRIBUTION:** Accidental, Newport, Cope.

Occurs in the West Indian fauna, common in the Florida Keys, occasionally northward in the Gulf Stream.

**SIZE:** Reaches a length of about 9 inches.



203. **Hairy Swellfish**  
*Tetraodon trichocephalus* Cope

Spines on the head long, close set, like seal bristles. Caudal fin truncate, with prominent angles. Brownish above, faintly vermiculated with lighter.

**DISTRIBUTION:** Known only from the type, 4 inches long, taken in the Gulf Stream off Newport.

The accompanying figure has been based on descriptions as the only known specimen was unavailable.



## PORCUPINE FISHES

Similar to the swellfishes but body covered with stout or long spines.

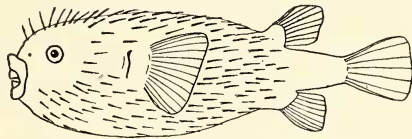
Spines long and sharp, body distensible.

*Diodon*

Spines short and stout, body little distensible, except in the very young.

*Chilomycterus*

**204. Porcupine Fish**  
*Diodon hystrix* Linnaeus



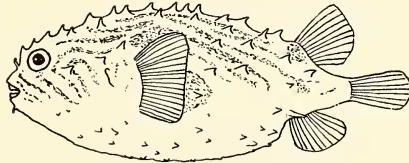
**DISTRIBUTION:** Accidental, once, Buzzard's Bay near Woods Hole August 12, 1895.

Occurs cosmopolitan in tropical seas, common north to Florida, drifting further north in the Gulf Stream. Small individuals are found among eelgrass and drift great distances in floating gulfweed, larger ones are common about coral reefs.

**LIFE HISTORY:** As the size increases the spots grow smaller and more numerous. Young individuals with several large black blotches have been called *D. holacanthus*.

**SIZE:** Reaches a length of 3 feet.

**205. Spiny Boxfish**  
*Chilomycterus schoepfi* (Walbaum)<sup>14</sup>



Upper parts with a series of undulating blackish stripes.

**DISTRIBUTION:** Uncommon in late summer and fall, June 30 to November 5. *Woods Hole*, of irregular occurrence, generally rare, September to November. *Orient*, rare, June 30 to October 28. New York, uncommon, July 8 to November 5, fairly regular in Sandy Hook Bay in fall.

Occurs from Cape Cod (casually Massachusetts Bay) to Florida.

**FOOD:** Feeds on small crabs, shrimps and other crustacea, and mollusks.

**LIFE HISTORY:** Both large and small examples are taken in the fall in Sandy Hook Bay. The small average about 60 mm. in standard length whilst the large average nearly 90 mm. Just south of our territory (At-

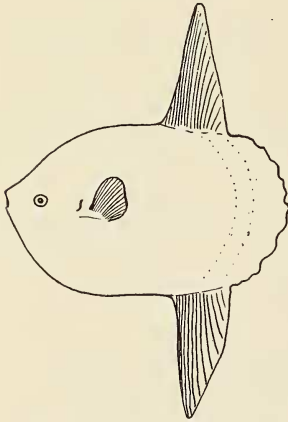
<sup>14</sup>The West Indian spiny boxfish, *Chilomycterus antillarum*, from Cuba and Jamaica, wherein the upper parts are covered with black hexagonal reticulations, is reported casual, at Woods Hole, *C. schoepfi* is subject to considerable individual variation, the status of related forms uncertain, and we do not feel justified in including this one here, on the basis of the data to hand.

lantic City) ripe fish have been taken in July which average about 19 cm. in standard length. The eggs are demersal, non-adhesive, highly transparent and average about 1.8 mm. in diameter.

SIZE: Reaches  $9\frac{1}{4}$  inches total length (Orient).

### SUNFISHES

Sluggish, compressed fishes with small mouths, the teeth more or less fused and nipper-like. Skin leathery, roughened like that of a pachyderm. No spines. Dorsal and anal fins high, flipper-like, the body ending immediately behind them, fringed by a narrow vertical caudal without a trace of peduncular constriction. A large off-shore fish.



206. Ocean Sunfish  
*Mola mola* (Linnaeus)

DISTRIBUTION: Rare in summer, June 2 to August 9. *Woods Hole*, rare, July and August. *Orient*, once, August 9, 1921, 4 feet long, 62 inches fin tip to fin tip, 250 pounds. *New York*, rare, June 2 to August 13 (1925, Sandy Hook Bay, about 4 feet long, estimated 300 pounds weight).

Occurs in most temperate and tropical seas, north to Cape Cod and more rarely to the Gulf of St. Lawrence on our coast.

To correlate the extraordinary form of this great fish with its habits would be an interesting contribution to the philosophy of the sea. We have seen it in calm weather close alongside a passing ship, making a pale mark at the surface where it lay flat on its side, fins moving a little, round pectoral projecting into the air.

FOOD: Includes salpae, amphipods, jellyfish.

LIFE HISTORY: The young is spiny and very different in appearance from the adult.

SIZE: The record fish (from California), 10 feet 11 inches long; 10 feet 9 inches from tip to tip; estimated weight over 2,000 pounds.

## SCORPION FISHES

Fishes of small size with a spiny and soft-rayed back fin of about equal length. A bony stay across the cheek, and strong spines about the large head. Ventral fins with the normal spine followed by five soft rays. Body covered by small scales.

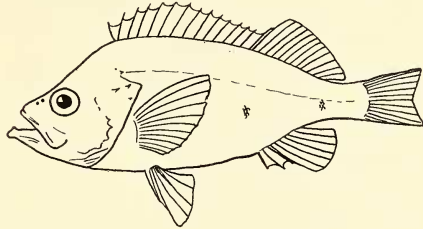
Dorsal spines more than 12.

Dorsal spines 12.

*Sebastes*  
*Scorpaena*

## 207. Rosefish

*Sebastes marinus* (Linnaeus)



**DISTRIBUTION:** Occasional. *Woods Hole*, December 20, 1895, several specimens stranded by the tide. Also recorded from New York, in that instance perhaps from deep water.

Occurs on the northern coasts of the North Atlantic, as a shore fish as far south as Maine, in deeper water to off the coast of New Jersey.

The rose-fish inhabits water of 50° or colder, and hence moves off-shore in summer from most of the New England coast where it is present in winter. It bites on any bait and its young are devoured in quantity by cod, larger rose-fish, and halibut.

**FOOD:** Consists mostly of various crustaceans, but also small fishes.

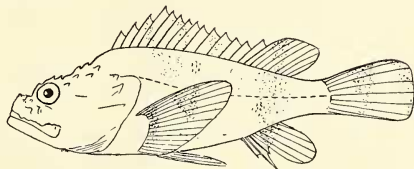
**LIFE HISTORY:** This deep water form occasionally taken without limits, is reported to be ovoviviparous, that is, the young are brought forth in an active state after the eggs have hatched within the ovaries.

They are liberated in summer, on no special grounds, but wherever the parent may happen to be. The eggs are buoyant, and the larvae (about 6 mm. long) pelagic.

**SIZE:** Reaches a length of about 2 feet.

## 208. West Indian Scorpion-fish

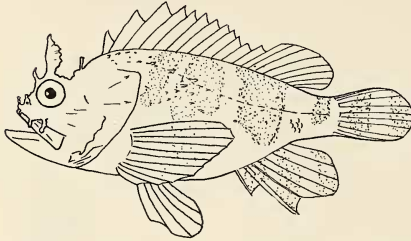
*Scorpaena plumieri* Bloch



**DISTRIBUTION:** *Woods Hole*, 20 specimens during August, September and October, 1899; 2 in 1900.

Occurs in the West Indian fauna from the Florida Keys to Brazil, casual northward.

SIZE: Reaches a length of about a foot.



### 209. Lionfish

*Scorpaena grandicornis* Cuvier  
and Valenciennes

DISTRIBUTION: Accidental, one September 29, 1899, Katama Bay.

Occurs in the West Indian fauna from the Florida Keys to Brazil, accidental in Massachusetts.

SIZE: Reaches a length of about 8 inches.

### SCULPINS

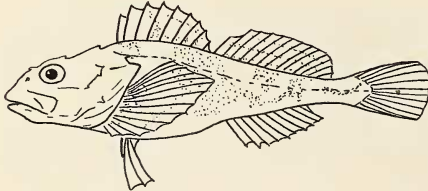
Fishes of small size with a spiny and soft-rayed back fin of about equal length, and bony stay across the cheek. Strong spines about the large head. Ventral fins with less than five soft rays. Body without true scales in our species, more or less warty and prickly.

9 or 10 dorsal spines.

*Myoxocephalus*

About 16 dorsal spines, of which the first 4 are more or less separate.

*Hemitripterus*



### 210. Brassy Sculpin

*Myoxocephalus aeneus* (Mitchill)

Anal fin with 10 or 11 rays. Brownish or coppery and white.

DISTRIBUTION: Permanent resident, uncommon to the westward and common to the eastward. *Woods Hole*, very common throughout the year. *Orient*, common except in summer, November 4 to June 8 (July 30). *New York*, uncommon permanent resident. Common in Sandy Hook Bay in 1925, 120 to 132 mm. ( $5\frac{1}{4}$  inches) standard length, not seen there the 5 previous summers.

Occurs on the coast of southern New England and New York. Has recently been recognized north to the Gulf of St. Lawrence, but there is possibility of confusion existing in the determination of sculpins of northern New England. Found in waters of 2 to 15 fathoms depth.

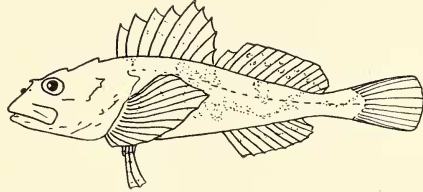
**FOOD:** Consists of worms, small crustacea, young fish and eel-grass.

**LIFE HISTORY:** Spawns all through the winter. Eggs taken from nets and seweed in March; observed hatching April 27 (Woods Hole). Eggs in a ripe fish of about 4 inches standard length (January) were bluish green in color, like a weak solution of copper sulphate, and measured 1.6 mm. in diameter.

**SIZE:** Reaches a length of 7½ inches (Orient).

### 211. **Mitchill's Sculpin**

*Myoxocephalus mitchilli* (Cuvier and Valenciennes)



Anal fin with 10 to 11 rays. Colors sharply black and white (or livid green).

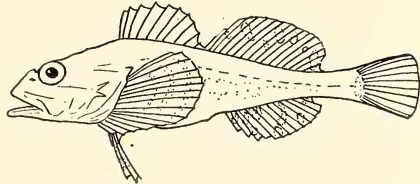
**DISTRIBUTION:** Uncommon or rare, mostly in the colder months. *Orient*, found throughout the year, sometimes common spring and fall; November 25 to December 4, April 14 to June 28. *New York*, rare. Long Beach, March 25, 1925 (87 mm. standard length).

Occurs in Long Island waters, so far as known.

**SIZE:** Small, usually around 4 inches total length, and reaches 6½ inches (Orient).

### 212. **Greenland Sculpin**

*Myoxocephalus groenlandicus*  
(Cuvier and Valenciennes)



Anal fin, of 12 to 14 rays. Upper preopercular spine moderate, about twice length of next spine.

**DISTRIBUTION:** Common to the eastward in winter, October to January. *Woods Hole*, common, December to January. *New York*, accidental, records may be referable to *mitchilli*.

Occurs from the Arctic Ocean south along the shores of New England.

Abundant "in all the bays and inlets of Greenland, but prefers a stony coast clothed in seaweed. It approaches the shore in the spring and departs in winter. It is very active and bold, but does not come to the surface unless it be led thither in pursuit of other fish. It is easily taken with bait, and constitutes the daily food of the Greenlanders, who are very fond of it. They eat the roe raw."

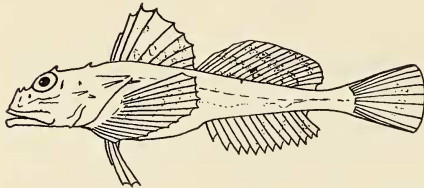


**FOOD:** "It is very voracious, preying on everything that comes in its way, and pursuing incessantly the smaller fish, not sparing the young of its own species, and devouring crustacea and worms."

**LIFE HISTORY:** Spawns in November and December (Woods Hole). In Greenland "It spawns in December and January, and deposits its red-colored roe on the seaweed." (Quotations from Fabricius, copied from Jordan & Evermann.)

The eggs are  $1\frac{1}{2}$  to 2 mm. in diameter, incubation is slow, occupying 4 to 12 weeks according to temperature. Newly hatched larvae are 7 or 8 mm. long. By late summer they may be  $1\frac{1}{2}$  inches long and resemble the adult, and most of them seemingly do not mature until at least 6 inches long or 3 years old.

**SIZE:** Reaches a length of 25 inches, one of the largest sculpins.



213. **Long-horned Sculpin**  
*Myoxocephalus octodecimspinosus*  
(Mitchill)

**Sculpin.** Anal fin of 12 to 14 rays. Upper preopercular spine very long, about 4 times as long as the next below it.

**DISTRIBUTION:** Abundant in winter, September through June, occasional in summer in somewhat deeper water. *Woods Hole*, abundant, October to January, a few in deeper water, July to September. *Orient*, common, October 1 through June. *New York*, abundant, September to May, occasional in summer. A wave of this species apparently approaches the length of our shore line simultaneously from deep water when the shore temperatures begin to fall in autumn, then withdraws westward somewhat from southern New England to winter most abundantly on Long Island; and there is an eastward movement again in spring on Long Island which does not reach New England, preceding or coincident with a return to deep water.

Occurs from Labrador to Virginia.

Sculpins are not at all valued as food, and yet what little is left of the fish when the inedible spiny head has been removed is excellent eating.

When landed on hook and line the long-horned sculpin assumes a defensive attitude as follows: it draws the upper jaw down and forward slanting the long preopercular spine up and back at an angle of  $45^\circ$ , and emits a low drumming sound. Other species of the genus have the same habit, perhaps most striking in this, the most heavily armed.

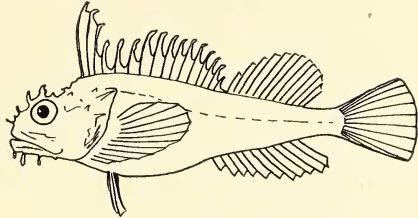
**FOOD:** The long-spined sculpin is a practically omnivorous carnivore. Small fish and crustaceans make up the bulk of its food, and it is also something of a scavenger.

**LIFE HISTORY:** Spawns in November and December, eggs often come ashore by the bucketful on Nobska Beach.

**SIZE:** Reaches length of about a foot, rarely  $1\frac{1}{2}$  feet.

### 214. Sea Raven

*Hemitripterus americanus* (Gmelin)



**DISTRIBUTION:** Rather common spring and fall migrant. April and May (June 28) occasional in somewhat deeper water July and August, coastwise again September to December. *Woods Hole*, May, occasionally dredged July and August, common October and November. *Orient*, October 15, in spring to June 28. *New York*, rather common, April and May, (August) September to December. Occurs from Labrador to Chesapeake Bay, common north of Cape Cod. *Sandy Hook Bay* May 27, 1926.

**FOOD:** The sea raven feeds on invertebrates---mollusks, crustacea, worms, etc., and to a less extent on small squid and fish. It has the power of inflating its belly when lifted from the water, as also of biting the hand that frees it. In our region it moves inshore in autumn and offshore in spring.

The stomach of one of 10 inches contained several squid 5 inches in length.

**LIFE HISTORY:** With eggs October 15 (*Orient*), November and December. The eggs are about 4 mm. in diameter, yellow soon changing to amber color, and sink and stick together in masses. The young have grown to a length of about 45 mm. by the following summer, and live on the bottom.

**SIZE:** Reaches 17 inches total length locally, weight  $3\frac{3}{4}$  lbs. (*Orient*). The largest on record measured 25 inches and weighed 5 pounds.

### SEA POACHERS

Small, little active fishes of cold seas or deep water, with comparatively large heads and slender tails. Body covered with bony plates, angulated.

### 215. Sea Poacher

*Aspidophoroides monopterygius*  
(Bloch)



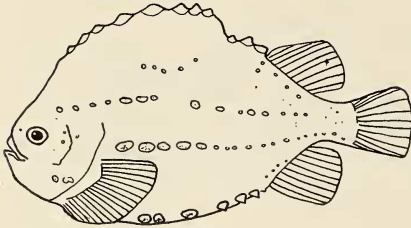
**DISTRIBUTION:** Accidental, New York, summer. There is doubt if this species has occurred here naturally above 25 fathoms depth.

Occurs in rather deep water from Greenland to Cape Cod.

**SIZE:** Reaches a length of about 6 inches.

## LUMP-FISHES

Fishes with rotund scaleless bodies, armed with rows of hard nodules, and a sucking disc on the breast.



216. Lumpfish  
*Cyclopterus lumpus* Linnaeus

**DISTRIBUTION:** Not uncommon in spring, April 1 to June 12. (About June 15, a half-grown fish, Fishers Island, H. L. Ferguson.) Young not uncommon to the eastward through the summer and fall, latest December 13. *Woods Hole*, adults common in spring, young found among driftweed till November. *Orient*, uncommon April 1, to June 12, young to December 13. *New York*, uncommon, April and May.

Occurs on the shores of the North Atlantic south to Long Island (casually Chesapeake Bay) and France. Common on rocky coasts, primarily a bottom fish, but also found in drifting weed. Said to be a favorite food of seals.

**FOOD:** Feeds on various invertebrates, including jellyfish, and occasionally small fishes.

**LIFE HISTORY:** Spawns in April (*Woods Hole*), to June 12 (*Orient*). Young taken in tow-net June 5 (*Woods Hole*), found among drifting weed throughout the summer till November (*Woods Hole*). Two inches total length recorded for a specimen on October 25, and 1½ inches for one on December 13 (*Orient*).

There is a general movement of this fish into shallower water to spawn, and deeper water after spawning. Large females (of 18 inches) produce up to 136,000 eggs. The eggs are 22 to 2.6 mm. in diameter, pink when first laid, becoming pale green or yellow and deepening in tint. They sink and stick together in large spongy masses through which the water circulates freely. Until the eggs hatch they are guarded by the male, who does not feed during this period, fans them with his fins to obtain circulation of water and freedom from silt, and drives off intruders. The young hatch at from 4 to 7.4 mm., and are at first actively pelagic. As they grow larger they hide in drifting weed, where they are abundant through the summer (to November, *Woods Hole*).

Off the coast of New England the surface of the green water is dotted with drifting fragments or larger masses of yellowish rockweed, frequently mixed with a little eelgrass, much as the warm blue ocean waters further east are dotted with sargassum. On the Maine coast in August it is interesting to find young lumpfish, an inch more or less in total length, hiding

in this drifting weed, and to compare their concealing color with that of the mouse-fish of the Gulf Stream. Unlike the color of the mouse-fish, that of young lump-fish, is highly variable, usually olive green, sometimes dark purplish, occasionally mottled grey. They have pale spots and bands anteriorly, usually more or less whitish or silvery and tinged with blue; such a band from the snout through the eye to the corner of the opercle, another between the eyes across the top of the head, and two short ones back of the gill cleft being pretty constant. There are apt to be pale spots on the sides, a reddish tinge posteriorly and on the fins. The eye is usually pink. If one examine details of the weed, bits will be found to match even the uniform dark purplish individuals. Possibly that this environment is with the lump-fish a temporary one, has something to do with the variety of its colors; possibly there is a greater range of color in rock than in gulf weed, and a standard low visibility pattern less possible. Bright marks, found also in mouse-fish, pelagic pipefish, and young of the yellow-jack, would seem to be an important feature of such a pattern.

**SIZE:** A specimen of 23 inches total length, 11 inches deep,  $7\frac{1}{2}$  inches broad, weight  $13\frac{1}{4}$  pounds recorded at Orient, and at the same locality one taken April 23, 1923,  $21\frac{1}{2}$  inches total length weighed 20 pounds.

#### SEA SNAILS

Small fishes related to the Sculpins, with long dorsal and anal, small rounded caudal, and broad pectoral fins—a sucking disc on the breast between the pectorals. Body and fins covered with loose scaleless skin.

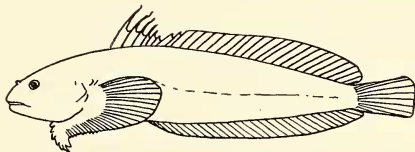
Dorsal fin divided by a deep notch.

Dorsal fin continuous.

*Neoliparis*  
*Liparis*

#### 217. New England Sea-snail

*Neoliparis atlanticus* Jordan and  
Evermann



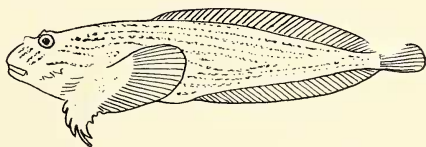
**DISTRIBUTION:** Rare at Woods Hole, August and September.

Occurs along rocky shores from Newfoundland to Cape Cod.

**SIZE:** Reaches a length of about 6 inches.

#### 218. North Atlantic Sea-snail

*Liparis liparis* (Linnaeus)



**DISTRIBUTION:** *Woods Hole*, common in winter, occasional in summer. Also recorded from off Block Island.

Occurs on both shores of the North Atlantic, north to Spitzbergen, commonest on the European side, south to Cape Cod on our coast.

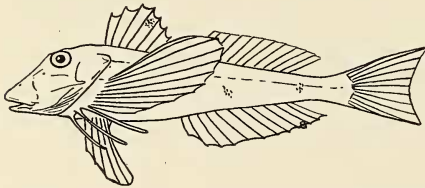
**LIFE HISTORY:** With spawn from December to March 26 (Woods Hole).

"A number of young examples of the sea snail, *Liparis liparis* (Linnaeus) were obtained from the mantle cavities of scallops at two stations, as follows:

"Forty-five miles E.S.E. from Assateague, Va., in 30 fathoms, and 45 miles E. by S. from Cape Charles, in 25 fathoms. These ranged in length from 20 to 29 mm. So far as known, this species has not been reported from so far south. A single example was also found in a scallop taken in 37 fathoms, 16 miles S. from Nantucket lightship" (W. W. Welsh, *Copeia*, No. 18, 1915).

### GURNARDS

Fishes with head entirely encased in a bony armature, and set with numerous spines. Breast fin large, with three fleshy tentacles before it.



219. **Carolina Sea Robin**  
*Prionotus carolinus* (Linnaeus)

A groove across the top of the head behind the eye. Pectoral fin not quite reaching middle of the soft dorsal. Brownish, with dark saddle-like marks on the back; dark under chin.

**DISTRIBUTION:** Common summer resident, April 15 to November 21 (adult) and December 3 (young). *Woods Hole*, common, May to October or later. *Orient*, common, April 15 (average April 25) to October 31 (adult) December 3 (young). *New York*, common, May to November 21 (in 21 fathoms). Apparently withdraws into deep water for the winter months, rather than migrating coastwise, southwestward.

Occurs from the Bay of Fundy to South Carolina, chiefly south of Cape Cod. Occurs at the bottom, coastwise in shallow water, and also in water of considerable depth, moving off shore for the winter.

Sea robins make grunting noises when caught and perhaps communicate by similar sounds when under water. One observed in a creek tributary to Moriches Bay, Long Island, resting with outstretched pectorals on the mass of thick-grown finely divided potamogeton, not more than a few inches below the surface of the water, when alarmed darted down and disappeared beneath the pond-weed with a very audible croak, 'grr,' analogous to the squawk of a startled frog or the grunting of a bittern flushed from the marsh.

This species runs into brackish and muddy water and at such times has a muddy taste. It prefers a sandy bottom and sometimes buries in the sand, all but the top of the head and eyes. Though seldom eaten because of the big spiny head, sea robins are a perfectly good food fish.

Sea robins are usually found at the bottom. They frequently move slowly forward, appearing to crawl by applying the thick fleshy tentacles in



front of the breast fin to the bottom, as though these were fingers. At times they swim towards the surface, perhaps in pursuit of some smaller fish, then spread the pectorals and by their aid glide gracefully back to the bottom again. Doubtless the big bony head gives these fishes a high specific gravity, correlated with expansion of pectoral fins to this purpose.

**Food:** A large part of its food consists of various small crustacea. It also eats small fishes, squid, worms, young bivalve mollusks, and seaweed.

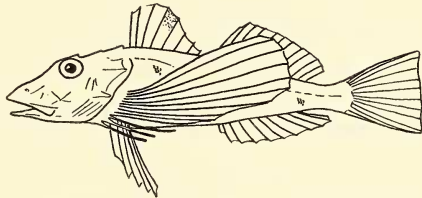
**LIFE HISTORY:** Young in November from 2 to 5 inches total length (Orient). Spawning takes place in June, July and August. From the examination of ripe females it is inferred that the eggs do not all mature at once. They are buoyant, spherical, slightly yellowish, highly transparent and range from 0.94 to 1.15 mm. in diameter. Between 10 and 20 oil globules are usually present. These are frequently arranged in an annular band corresponding to the "tropic of Capricorn," taking the germinal disc as "north." Incubation at 58° F. occupies about 60 hours. On hatching the larvae are about 2.6 mm. long. The larval pectorals foreshadow the large ones of the adult. At five days the fish average about 3.2 mm. At 30 mm. they show most of the adult characteristics. Young of many varied sizes are taken throughout the year, which fact makes an estimate of the growth rate extremely difficult.

In Sandy Hook Bay fish averaging 150 mm. in standard length are taken from June to August. Young fish appear in October which average 80 mm.

**SIZE:** Reaches 16 inches total length, weight  $1\frac{3}{4}$  pounds (Orient).

## 220. Striped Sea Robin

*Prionotus evolans strigatus* (Cuvier and Valenciennes)



No cross groove on the head. Pectoral fins longer. Sides pale with two distinct narrow lengthwise stripes; light under chin.

**DISTRIBUTION:** Common summer resident, May 4 to November 15. *Woods Hole*, common, adults May and June, young till November. *Orient*, uncommon, May 4 to November 15. *New York*, common, May 4 to November 4.

Occurs from Massachusetts Bay to South Carolina, chiefly south of Cape Cod.

**Food:** Feeds mostly on crustaceans and mollusks.

**LIFE HISTORY:** Spawns in summer. Young  $\frac{3}{4}$  inches long and upward throughout the summer (*Woods Hole*).

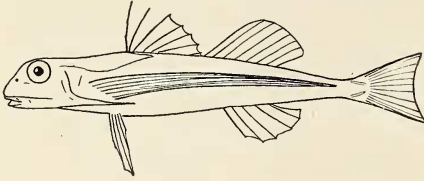
Young fish taken in Sandy Hook Bay during August average about 55 mm. in standard length; by October 1 they average about 70 mm.; ripe fish averaging about 260 mm. ( $10\frac{1}{4}$  inches) taken in June, examples of

about 110 mm. in October are probably a little over a year in age. South of our territory large ripe adults were taken in August (Atlantic City). The eggs were demersal, non-adhesive, highly transparent and averaged about 1.1 mm. in diameter.

SIZE: Reaches a length of about  $1\frac{1}{2}$  feet.

### FLYING GURNARDS

An anterior spiny back fin. Entire head encased in a bony armature. No fleshy tentacles before the breast fin, which is very long and broad.



#### 221. Flying Gurnard

*Cephalacanthus volitans* (Linnaeus)

DISTRIBUTION: Rare in fall, August 28 to October 28. *Woods Hole*, a few every year late in the fall, recorded August 28. *Orient*, rare, October 19 to October 28. *New York*, rare, August to October.

Occurs in the warm waters of both coasts of the Atlantic.

The flying gurnard makes long leaps supported by its large pectoral fins, but its aerial powers in no wise compare with those of the true flying-fishes. It jettisons above the surface of the water and then volplanes downward with pectorals spread, an act apparently homologous to that described above for the sea robin, but in that case entirely under water.

Dr. F. A. Lucas remembers (1870) taking young of this species 3 or 4 inches long associated with squid from the stomach of a bonito in mid-Atlantic a little north of the equator. Probably the young of this size are pelagic.

SIZE: Reaches 12 inches.

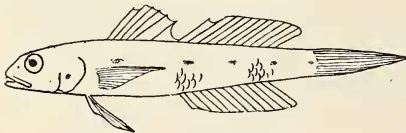
### GOBIES

Small bottom fish, with two short separate dorsal fins, the first of slender spines. Ventral fins united.

Body scaly.

Body scaleless.

*Gobius*  
*Gobiosoma*



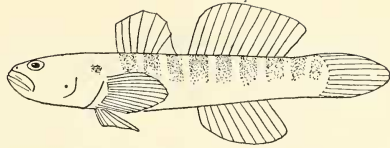
#### 222. Goby

*Gobius stigmaticus* (Poey)

DISTRIBUTION: Accidental, one record, *Woods Hole*, October 4, 1906.

Occurs in the West Indian fauna from North Carolina to Brazil.

SIZE: Reaches a length of about 5 inches.

223. **Naked Goby***Gobiosoma bosci* (Lacépède)

**DISTRIBUTION:** Rather uncommon in summer and fall, usually overlooked. *Woods Hole*, common, summer. *Orient*, once, October 30. *New York*, rather common, autumn.

Occurs from Cape Cod to Florida. Frequents shallow grassy bays, common southward.

**SIZE:** Total length of an *Orient* specimen,  $1\frac{1}{4}$  inches.

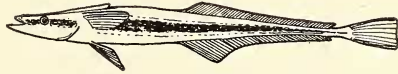
## REMORAS

Small fishes, with flattened head, the top of which is occupied by a peculiar oval sucking disc with cross lamellae like the slats of a blind. By the means of this sucker they attach themselves to sharks and other large moving objects.

Body very slender, pectorals pointed with flexible rays, lower jaw produced in a flap.

Body stout, pectorals rounded, with flexible rays.

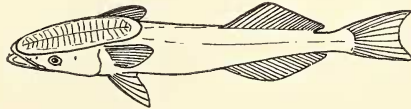
Body stout, pectorals rounded, their rays stiff.

*Echeneis**Remora**Rhombochirus*224. **Shark Remora***Echeneis naucrates* Linnaeus

**DISTRIBUTION:** Not uncommon in summer, July 7 to October 11. *Woods Hole*, not uncommon in summer. *Orient*, a specimen taken every year or two. *New York*, not uncommon, July 7 to October 11.

Occurs in warm seas, cosmopolitan, north to Cape Cod (casually Massachusetts Bay). Locally it is usually found attached to ground sharks (*Carcharhinus*). Occasionally attaches itself to other large coastwise fishes, as the tarpon.

**SIZE:** Reaches 38 inches total length, weight  $1\frac{3}{4}$  pounds. (*Orient*.)

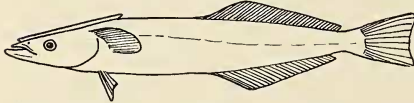
225. **Off-shore Remora***Remora remora* (Linnaeus)

About 18 cross plates in the sucking disc, and 23 rays in the dorsal.

**DISTRIBUTION:** Casual, usually attached to large sharks. *Woods Hole*, September 14, 1898. *New York*, casual. Three recorded in Sandy Hook Bay, July 30, and September 4, 1925, all attached to loggerhead turtles (*Caretta caretta*).

Occurs cosmopolitan in warm seas, more pelagic than *Echeneis*, casually north to Salem, Mass.

SIZE: Reaches a length of 15 inches.



**226. Swordfish Remora**

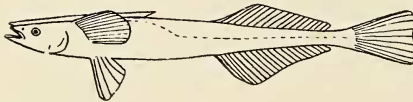
*Remora brachyptera* (Lowe)

14 to 16 cross plates in the sucking disc, 29 to 32 rays in the dorsal.

DISTRIBUTION: Rare at Woods Hole.

Occurs cosmopolitan in warm seas, occasionally north to Cape Cod, and probably more than casual in the Gulf of Maine also, where the swordfish is of regular occurrence, though records north of Massachusetts Bay are few. Has been taken from the gill cavity of the sea sunfish *Mola mola*, and is more frequently found clinging to the shoulders of the swordfish.

SIZE: Reaches a length of about one foot.



**227. Spearfish Remora**

*Rhombochirus osteochir* (Cuvier)

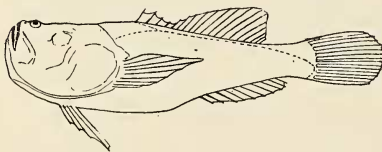
DISTRIBUTION: Woods Hole, 2 records, one of these August 6, 1886.

Occurs in the West Indian fauna, north to Cape Cod. Attaches to spearfishes and sailfishes. Can frequently be picked up among the sailfishes landed on the dock at Miami, Florida. Hence it may be deduced that it sometimes attaches within the gill cavities of these fishes. Attached to the outside it would likely drop off and be lost earlier. Two large ones (gray instead of the usual tan color) taken from gill cavity of *Tetrapterus imperator* off Bimini, Bahamas (Van Campen Heilner).

SIZE: Reaches a total length of  $8\frac{1}{2}$  inches.

**STAR-GAZERS**

Sluggish, southern bottom fishes, with large heads, chunky bodies, rounded fins, a small spinous dorsal. Head squarish; eyes on top of head, far forward. Mouth vertical.



**228. Spotted Stargazer**

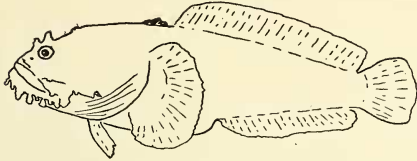
*Astroscopus guttatus* Abbott

DISTRIBUTION: Accidental, fall, New York.

Occurs from Virginia casually north to Long Island.

## TOADFISHES

The toad-fish is a big-headed depressed tadpole-shaped fish with a big transverse bulldog mouth. The fins are normal and rounded, the pectorals not placed on short arm-like bases. Ventrals decidedly anterior to pectorals, spinous back fin very small.

229. **Toadfish**

*Opsanus tau* (Linnaeus)

**DISTRIBUTION:** Common permanent resident. *Woods Hole*, common permanent resident. *Orient*, abundant resident but not recorded from the Sound; hibernates in mud from first frost till April. *New York*, common permanent resident.

Occurs from Cape Cod (casually Maine to Cuba). Generally distributed in shallow water, frequently hiding among weeds or under stones.

One frequently finds a toad-fish isolated in some pool of water left by the falling tide, but it is dangerous to try to catch such an individual by hand, because of the chance of receiving a severe bite. One may frequently see them lying on the bottom beside some pier; when in such a position, if they be annoyed with a stick they will sometimes fasten their jaws—with firmly set short blunt teeth—upon it so tenaciously that they may be lifted out of the water.

At *Orient*, thousands hibernate in the mud in Long Beach Bay. They disappear in the mud at the first frost, and regardless of weather thereafter rarely appear till April. This species takes the hook freely, baited with fiddler crabs. It is stated that it makes a grunting sound, especially at night, or if handled.

Despite its pugnacity, the red-breasted merganser has been known to swallow a toad-fish of 130 mm. total length, head first and whole.

**FOOD:** Feeds on crustacea, small fish, mollusks, worms, etc.

**LIFE HISTORY:** One or both parents guard the eggs, usually placed in some crevice, empty shell, tin can or old shoe, until hatched. The young hide among weed before taking up life on the bottom.

The toadfish spawns during June and July. A medium sized female in the New York Aquarium deposited 60 eggs on July 12, 1921, when the water temperature averaged 67° F. The eggs were attached to the glass sides of the aquarium in a single-layered cluster by their prominent adhesive discs which at once distinguishes them. In a state of nature the eggs may be attached to any submerged object. The eggs are large, averaging 5 mm. in diameter and are of a deep amber color. Development proceeds as in the typical teleostean egg and incubation occupies from 10 to 26 days depending on the temperature. On hatching, the larval toadfish do not leave



their place of attachment but remain adhering by means of the yolk sac until it is absorbed. At this time they are about 16 mm. in length and resemble the adults in all essentials. Apparently by the next summer they may attain a length of about 90 mm. Their age and size at maturity is not definitely known, although the average breeding fish is about 230 mm. long. A length of 280 mm. (11 inches) is recorded but such a size is very unusual.

SIZE: Reaches a length of 15 inches.

### BLENNIES

There are two types of blennies, a northern and a tropical type, both of which are represented in our fish fauna. The former have body elongate and compressed, band or eel-shaped, a well marked rounded caudal fin, long low dorsal occupying the whole back, its rays spinous.

The southern type of blennies are small bottom or weed fishes, ventral fins placed farther forward than breast fins. With or without scales, but our single species scaleless. They have spines and also a variable number of rays in the dorsal fins, sometimes separated into a spiny and soft portion, but when so the two joined at the base.

- a. Scaleless. Dorsal of 11 spines and 19 soft rays body not elongate.

*Chasmodes*

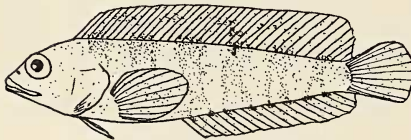
Covered with minute smooth scales. Dorsal entirely of spines. Body more elongate (see b).

- b. No lateral line. Depth 7 or 8. Dorsal spines between 70 and 90.

*Pholis*

Two lateral lines. Depth about 5. Dorsal spines between 40 and 50.

*Ulvaria*



230. **Striped Blenny**

*Chasmodes bosquianus* (Lacépède)

DISTRIBUTION: *New York*, occasional.

Occurs from *New York* to *Florida*.

Common in shallow water, the young very concealingly colored, hiding among weed.

SIZE: Reaches a length of about 5 inches.



231. **Rock-eel**

*Pholis gunellus* (Linnaeus)

DISTRIBUTION: Abundant permanent resident to the eastward and uncommon in winter to the westward. *Woods Hole*, permanent resident, abundant along shore in early spring, at other times only in moderately

deep water (3-13 fathoms). *Orient*, young occur in winter, October 22 to June 13 (June 20), common in early December. *New York*, uncommon, autumn and winter (January). Our eastern borders lie within the permanent range of this northern fish. The migration of the adults appears to be to and from the shore. That of the young more along the coast.

Occurs on the coasts of the North Atlantic, south to Woods Hole (rarely New Jersey) and France. This fish is common along shore, usually in shallow water, hiding in the crevices of rocky or pebbly ground and in seaweed. It is agile and eel-like in its motions.

Elements of the characteristic color pattern of this species are a series of small black pale-rimmed blotches along the base of the dorsal fin, extending onto the same, and a banded anal. The general color is olivaceous or grayish. An individual spewed up in a barrel containing cod and haddock from 15 or 18 fathoms of water off Camden, Me., was per contrast clear light red in color to match the ascidians (*Boltenia ovifera*), algae, etc., of that bottom.

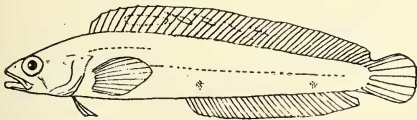
**FOOD:** Its food consists, so far as known, of worms, small crustaceans and molluscs.

**LIFE HISTORY:** Young taken in tow from April to July (Woods Hole). At *Orient*, total lengths of  $3\frac{1}{2}$  inches reported for November and December,  $2\frac{1}{2}$  and 5 inches for early June.

The rock eel spawns in the colder months of the year. The eggs are about 2 mm. in diameter, whitish opaque, iridescent on the surface, with a single oil globule, and are laid in holes or crannies where they stick together. Incubation occupies from 6 to 10 weeks and the young hatch at about 9 mm. They live at the surface until 30 or 40 mm. in length, and then sink to the bottom, in late summer or autumn.

We have seen a fish  $4\frac{5}{8}$  inches in total length, but recently dead, curved about its eggs within an empty oyster shell, and so brought to Nagele Bros. fish market, N. Y. from Peconic Bay in mid December; these eggs counted by Dr. E. W. Gudger as 686.

**SIZE:** Reaches a length of 12 inches.



### 232. *Ulva*-fish

*Ulvaria subbifurcata* (Storer)

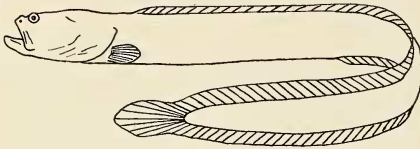
**DISTRIBUTION:** Four living specimens recorded from the western portion of Vineyard Sound during July and August at depth of 5 to 12 fathoms. Vinal Edwards reports having found several (perhaps 10 or 12) of these fishes in the crop of a sheldrake, shot near Robinson's Hole, December or January, 1907-8.

Occurs in the North Atlantic, south to Cape Cod, very rare southward. Found among seaweed and under stones, from low tide mark down to at least 30 fathoms.

**SIZE:** Local specimens have been between 1 and 4 inches long, the species grows to  $5\frac{3}{8}$  inches, perhaps considerably longer.

### GHOST-FISHES

Body elongate, rather eel-shaped, but with a well differentiated caudal fin, rounded or bluntly pointed. Head large, squarish, the eyes placed high and far forward, the mouth large, vertical.



#### 233. Ghostfish

*Cryptacanthodes maculatus* Storer

**DISTRIBUTION:** Occasional in winter, December and January. *Woods Hole*, occasional, December and January. *New York*, occasional. Occurs from Labrador to Long Island Sound.

**FOOD:** Its food consists of crustaceans, mollusks, and fishes.

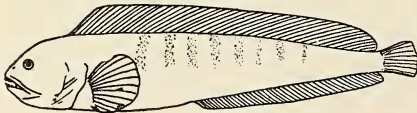
This is a bottom fish occurring from the shore down to considerable depths. It has been found inhabiting burrows in a mud flat, from above low water mark downward, "each system of burrows, inhabited by only one fish, consisted of branching tunnels about 5 cm. in diameter and from 3 to 8 cm. below the surface, originating from a more or less centrally placed mound in which was the main entrance, with other smaller openings along the tunnels and at their terminations."—(Bigelow and Welsh).

**LIFE HISTORY:** A winter spawner in the Gulf of Maine for Bigelow and Welsh have obtained its late larvae and fry ranging from 18 to 40 mm. long there in spring. Young of 21 or 22 mm. are relatively less elongate than the adult, caudal fins larger and square, mouths still nearly horizontal. They are thickly speckled above with dark brown dots which become sparser on the lower sides.

**SIZE:** Reaches a length of about 3 feet.

### WOLF-FISHES

Body elongate, compressed, but scarcely eel-shaped. Back fin long and high, the rays all flexible spines. A separate rounded caudal fin. Mouth with conspicuous large canine teeth.



#### 234. Wolf-fish

*Anarhichas lupus* Linnaeus

**DISTRIBUTION:** Rare. *Woods Hole*, rare, *New York*, rare.

Occurs on northern shores of the North Atlantic, south to Cape Cod (rarely New Jersey) and France.

The wolf-fish is a solitary species, rather common to the northward, living on rocky or stony bottom, usually in rather deep water. It is a weak swimmer, moving in an eel-like manner. When caught it snaps viciously with its formidable teeth and with excellent aim. Though repellant in appearance it is an excellent table fish.

**FOOD:** Consists of hard-shelled molluscs, crustaceans and echinoderms.

**LIFE HISTORY:** The spawning season of the wolf-fish is in winter. Its eggs are very large, 5.5 to 6 mm. in diameter, yellowish opaque, and are laid on the bottom where they stick together in large loose clumps among weed, stones, etc. The slender, transparent larvae are about 12 mm. long at hatching, with an enormous bag-like yolk sac inclosed in a net of highly developed blood vessels, which gradually shrinks as they grow, when first hatched they lie on the bottom resting on the yolk sac. They have been taken from 21 to 44 mm. long swimming free, the yolk absorbed, in March and April, at, or more often some fathoms beneath the surface. Compared to other species young wolf-fish drift at the mercy of the currents, at most for a short period, or perhaps even sometimes not at all. Larvae of 20 to 22 mm. with large head, enormous eyes and tiny teeth, without definite separation between dorsal, caudal and anal fins, silvery on the sides at this stage, look very unlike the adult.

**SIZE:** Reaches a length of 5 feet and weight of about 30 pounds.

### EEL-POUTS

Not greatly elongate eel-like fishes. Dorsal and anal fins, of soft rays. Pectorals large and rounded; ventrals very small, at the throat. Lower jaw included.

Dorsal fin ending abruptly near tail, anal fin below continuous with caudal fringe.

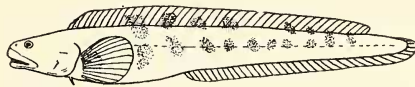
*Zoarces*

Dorsal and anal fins of equal height, confluent at tip of tail.

*Lycodes*

#### 235. Shore Eelpout

*Zoarces anguillaris* (Peck)



**DISTRIBUTION:** Permanent resident, abundant in fall and winter to the westward. *Woods Hole*, less numerous than formerly. *Orient*, rare, March to June 4; October 12 to December 19. *New York*, resident, abundant in fall and winter.

Occurs from Labrador to Delaware.

In the vicinity of New York City the eel-pout is almost universally known to the fishermen as 'conger eel,' although this name rightly belongs to a true eel which is very dissimilar.

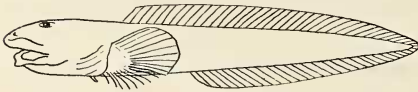
In Maine this fish comes close in to the shore and shallow water, more or less, in summer. In our region it is found in moderately deep water, with probably some inshore tendency in winter.

The break in the contour of the shore eel-pout's vertical fins just over the tail, where soft rays are replaced by a series of short spines, giving the fish a peculiar and diagnostic appearance, is apparently a defense adaptation. We have had this in mind in taking one from a hook, and noticing how it coiled back on itself, jaggng the hand with these spines.

**FOOD:** Its food consists of molluscs, crustaceans and other invertebrates; to a less extent, fish.

**LIFE HISTORY:** Probably spawns in autumn. The eggs have been estimated as 1,800 in a female of  $3\frac{3}{4}$  pounds, as against 200 to 400 in the otherwise closely related European fish of this genus which is ovo-viviparous, but the breeding habits of our form are not known. The growth of the eel-pout in the Bay of Fundy has been estimated as follows from a study of otoliths, —first year 1.5 to 4 inches, ninth year 16.4 to 20 inches, seventeenth year 24.6 to 27.2 inches, maturity reached when about 8 years old. If these estimates are correct it is an unusually long-lived fish.

**SIZE:** Said to reach a length of  $3\frac{1}{2}$  feet and weight of 12 lbs. Usual maximum between 2 and 3 feet.



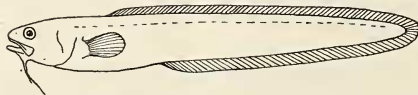
236. **Reticulated Eelpout**  
*Lycodes reticulatus* Reinhardt

**DISTRIBUTION:** Rarely taken in Vineyard Sound. Occurs on both shores of the North Atlantic, south to Narragansett Bay, in 17 fathoms of water and more.

**SIZE:** Reaches a maximum length of about 22 inches.

#### CUSK EELS

Elongate, compressed, eel-shaped fishes. Scales minute, inconspicuous. Back fin continuous with the anal fin around the tail; ventral fins each represented by a forked barbel placed at the chin or throat.



237. **Slippery Dick**  
*Rissola marginata* (DeKay)

**DISTRIBUTION:** *New York*, occasional, October to October 30.

Occurs from *New York* to *Texas*, not common. Frequents sandy shores, burrowing in the sand.

**SIZE:** Reaches a length of about 6 inches.

#### SILVER HAKES

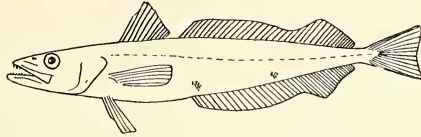
Symmetrical, large-mouthed, silvery, free-swimming fishes. No spines in the fins or elsewhere. The caudal fin small, squarish, on a narrow peduncle. Two dorsal fins, the first short, the second long. Mouth large;



lower jaw projecting; with numerous strong, sharp, pointed teeth, larger than in the codfishes.

### 238. Silver Hake

*Merluccius bilinearis* (Mitchill)



**DISTRIBUTION:** Permanent resident, abundant in October, November and December, uncommon or irregular at other seasons. *Woods Hole*, abundant in fall, October 3 to December, sometimes common in summer, recorded March 3. *New York*, usually abundant in fall, October 18 to December, sometimes in spring, May to June 1, uncommon in summer and present in winter.

Occurs from the Grand Banks to New York and to off the Bahamas in deep water, most abundant between Cape Sable, N. S., and Cape Cod.

The silver hake is peculiarly adaptable to depths of water being found from near the surface close in shore to depths of 300 fathoms, and it probably does not keep particularly close to the bottom. In the northern part of its range its principal seasonal movement is referable to spreading inshore with the approach of summer and retreating off shore in fall. Whether the numbers which invade our region in late fall work in from off shore as the water cools to suit their taste or are migrants from the northeast, must at present be left to conjecture.

This is a very nice table fish if eaten perfectly fresh, but soon softens.

Usually found over sandy or pebbly bottom. Frequently drives its prey so close inshore that both pursued and pursuer strand on the beaches, especially at night.

**FOOD:** A strong swift swimmer, very voracious, feeds on fish, also small crustacea, crabs (*Woods Hole*). A  $23\frac{1}{4}$  inch specimen, Orient, November 12, had in its stomach 75 herring (*Clupea harengus*), 3 inches long.

**LIFE HISTORY:** Spawns in water of moderate depth. Young recorded 4 inches total length March 3, 6 inches total length June 9 and July 13 (Orient), 8 inches standard length, October 17 to 21 (*Sandy Hook Bay*). The spawning of the whiting or silver hake is at its height in July. The eggs are spherical, highly transparent and range from 0.88 to 0.95 mm. in diameter. They are buoyant. A large, deep yellowish-brown oil globule is present in the yolk. Incubation occupies about 48 hours at a temperature of 72° F., but this is water considerably warmer, than that in which they usually spawn, and the period should be longer in cooler water. The newly-hatched larvae measure about 2.8 mm. in length and are rather slender. The vent is immediately behind the yolk sac and lateral at the base of the ventral fin fold. Up to 23 mm. at least the caudal is rounded, not lunate as in the adult. By the time 30 mm. is reached most of the diagnostic characters of the adult have been attained, and probably the young take to the bottom at about this size, and during their first autumn.

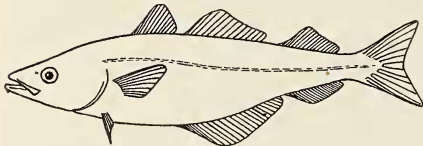
Ripe fish averaging about 300 mm. (1 foot) in standard length are taken in Sandy Hook Bay in May and June. One such female of  $12\frac{5}{8}$  inches taken June 3, 1925 contained a squirrel hake 6 inches long standard, and three of its own kind measuring  $4\frac{3}{4}$  to  $5\frac{1}{2}$  inches. These latter were no doubt yearlings, and those taken in the latter part of October which measure some 200 mm. (8 inches) must be of the same age class, having grown fast during the summer.

Size: Reaches  $23\frac{1}{4}$  inches total length (Orient).

### CODFISHES

Usually cold-water fishes, large or small, with fine scales; fins always spineless. The mouth is large, upper jaw usually slightly the longer, and often a small barbel at the chin. There are sometimes three separate dorsal and two separate anal fins, which is diagnostic when the case. Sometimes there are but two dorsals the first short, the second long occupying the remainder of the back, a single long anal fin. In this case the ventral fins are filamentous, placed far forward under the gill openings.

- a. Three separate dorsal and two separate anal fins (see b).  
One continuous anal, sometimes notched, dorsal not divided into 3 (see e).
- b. Lower jaw projecting, tail fin somewhat forked. *Pollachius*  
Lower jaw included, tail fin not forked (see c).
- c. Mouth large, lateral line pale (see d).  
Mouth small, lateral line black. *Melanogrammus*
- d. Vent in front of second dorsal, size small, ventral fin narrow with a long filament at the corner. *Microgadus*  
Vent below second dorsal, size large, ventral fin comparatively broad with a short filament at the corner. *Gadus*
- e. Front of dorsal separated as a distinct fin (see f).  
Front of dorsal continuous with remainder of fin. *Brosme*
- f. Anterior dorsal of several rays, like those in second dorsal, ventral of two or three slender rays. *Phycis*  
Anterior dorsal of a single ray followed by a band of fringes, ventrals with several rays (see g).
- g. Barbels 3, at chin and at each nostril. *Gaidropsarus*  
Barbels 4, one at tip of snout in addition to the above. *Rhinonemus*



239. Pollack  
*Pollachius virens* (Linnaeus)

DISTRIBUTION: Present at all seasons, adults uncommon, young common to the eastward, January through summer and fall. *Woods Hole*, adults

formerly common, now uncommon, May. Young first recorded January, most abundant April, a run in the fall. *Orient*, young common in summer, adults rare, recent records May 29 and June 14. *New York*, occasional, most often in winter, sometimes summer. Occurs in the North Atlantic south to Cape Cod, (rarely New York and casually Chesapeake Bay) and France.

The pollack is a more active fish than its congeners the cod and the had-dock, and swims nearer the surface on the average, at any level between bottom and surface in fact.

**FOOD:** It congregates in large schools, and wanders widely in pursuit of feed, which consists mostly of fishes, but smaller crustaceans are also eaten extensively. Experiments on captive fish at Woods Hole have shown that it relies on keen sight more than scent in capturing food.

Young of about 5 inches total length in July and August observed feeding on the young of the squid (*Loligo pealii*) about 1 inch long (*Orient*).

**LIFE HISTORY:** Spawns chiefly in depths of 15 to 50 fathoms. Young taken in the tow at Woods Hole from January to May, most abundant in April, about 1½ inches long. At *Orient* they average 5 inches total length July and August. These are probably fish less than a year old, which grow little during the winter, for young pollack average 5 or 6 inches long the second spring, 12 inches the third spring. Bay of Fundy fish when 3½ years old are 14 to 18½ inches long. The pollack may ripen when as small as 6 inches and most of them do so by the time they are 18 inches long. The annual rate of growth amounts to about 6 inches for the first two years, 4 inches for the next 2 or 3, then an annual increase of 1½ to 2 inches. Young pollack are common in the harbors of the Maine coast in summer.

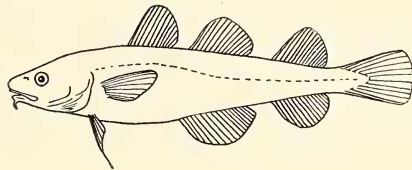
This species spawns in October, November and December. The eggs are pelagic, non-adhesive and average about 1⅓ mm. in diameter. The usual number per female is over 200,000 and the maximum over 400,000. At a temperature of 43° Fahr. they hatch in about 9 days and the yolk sac is absorbed in 5. The larvae are about 3.6 mm. long at hatching. At 12.5 mm. the caudal (lunate in the adult) is already slightly edentate. The average size of adult fish is 4 pounds and the maximum about 20 pounds.

Pollack tend to keep more to the surface than their associates of the same family.

**SIZE:** One of 21 pounds, length 36 inches, taken locally (*Orient*). The maximum recorded length in the Gulf of Maine is 3½ feet, weight about 35 pounds.

#### 240. Tomcod

*Microgadus tomcod* (Walbaum)



**DISTRIBUTION:** Abundant in winter, a few present in summer. *Woods Hole*, abundant in winter, taken throughout the year. *Orient*, common from September to May, rare in summer, often taken from mud in winter, seldom met with in the Sound. *New York*, abundant in fall, (October 17), early winter and sometimes early spring, uncommon in summer. In 1925, comparatively common all summer in Sandy Hook Bay, up to 10¾ inches in length.

Occurs from Labrador to Virginia.

In our region most of the tomcod move off shore in summer from the mouths of the streams where they have spawned, a sufficient distance to find deep water of an agreeable coolness. Further northeast they remain close to shore through the year. This species lives close to the bottom and depends, as proved by experiment, at least to some extent, on its chemical senses to find its food. It is not a very active swimmer.

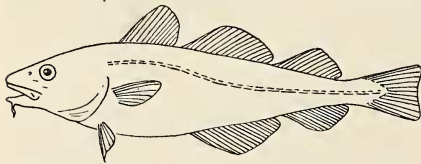
The tom-cod is a delicious pan fish and is fished for extensively in the colder months when it is running in shore to spawn. It can sometimes be taken in numbers from the wharves of the New York City waterfront. With a sleigh-bell on top of a spike stuck in the wharf, to which the line is attached, the boy fisherman may not only operate several lines at once, but keep his hands in his pockets if the air is frosty, and be advised by the cheerful tinkling of the bell whenever he has hooked a fish.

**FOOD:** Feeds on annelids, shrimps, amphipods and other small crustacea, also squid and various small fishes.

**LIFE HISTORY:** Spawns in December; young taken in the tow from January to April, most frequently March and April (*Woods Hole*).

The tomcod spawns near shore or in streams which are sometimes practically fresh from November to February. The ova are heavy, non-adhesive and average about 1½ mm. in diameter. The average number deposited is about 25,000 and the maximum is nearly 44,000. Hatching occurs 35 days after oviposition at a temperature of 40° Fahr. The larvae, at hatching are about 5 mm. long, larger than those of the cod. Four days later the yolk sac is absorbed and the little fish must forage for itself. It reaches a length of 2½ to 3 inches by the following autumn. This species seldom exceeds one foot in length.

**SIZE:** Reaches 15 inches total length, 1¼ pounds. weight, usually smaller. In June in Sandy Hook Bay adults average about 10¼ inches in standard length, a smaller group in fall ranges from 5 to 9 and averages about 7 inches.



241. Cod

*Gadus callarias* Linnaeus

**DISTRIBUTION:** Resident to the eastward, to the westward only found in winter, except stragglers; abundant. *Woods Hole*, abundant, keeping in



deep water in winter and summer but coming to shore in fall and spring. April 1 to mid-May, October to wintry weather. *Orient*, winter resident, October 22 to June 7. *New York*, sometimes abundant, September 28 to May 29, small specimens ('rock cod') occasional in summer.

Occurs in the North Atlantic south to Virginia and France.

As regards wanderings and migrations, cod may, it seems, be differentiated into two categories. Some are more or less resident, but the schools are constantly on the move. At the northern end of its range the species enters the cold shore waters only in summer, but in general there is a spawning migration inshore in winter. This may account in part for the winter cod at the western end of our region, but that they are in part referable to a distinct east-west migration is proved by tagging experiments at Woods Hole and Nantucket shoals, a method of investigation well worth carrying farther.

The cod ranges at least as deep as 250 fathoms, and also comes close in to the shore. As a rule it swims close to the bottom, rocky, pebbly or sandy preferred, soft mud avoided. In the pursuit of small fish or squid, however, especially the capelin, even adult cod sometimes come to the top of the water.

The use of the term 'rock cod' for small individuals differing in color from the general run of large fish, apparently does not always refer to an identical variation. On ledges off the Maine coast in August, where cod varying somewhat in size were being taken, some of the smallest individuals, 15 inches in total length, were red (speckling darker and redder, whole fish more pigmented). These were either on bottom with red algae, etc., or associated with red strands of kelp which they matched closely in tone; and with them were other fish, both larger and of the same size, of standard color. It was as though fish of about this size which had been living close to the kelp or weed, assumed the adult color, probably correlated with a wider range. Again a small, slender 'rock cod,' dark colored with light spots, more contrasted in appearance in a boatload of the standard form landed at Cape Ann in February, may have owed its differences to summer life inshore, though now taken in moderately deep water, and it seems to represent a more tangible ecological variation, though presumably one resting on the history of the particular individual.

As a general food-fish the cod is superior to its relatives, the pollack and haddock, although with special cooking they are also fine and may well be more agreeable to certain palates than the cod. The flesh of the pollack being comparatively oil-less, is improved by cooking with fat pork or some such material; that of the haddock, which has a tendency to be too firm and dry, is unsurpassed as the basis of a chowder.

FOOD: Feeds on mollusks, worms, herrings, lants, crabs (the triangular *Hyas coarctatus* on ledges off the Maine coast), shrimps, brittle stars, and in fact any animal food that would recommend itself to a fish swimming over the sea bottom in hungry hordes; young observed feeding on copepods (Woods Hole).

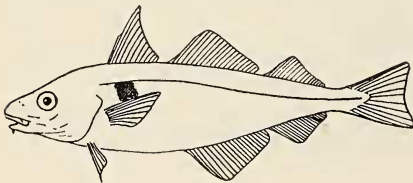


**LIFE HISTORY:** Young  $\frac{1}{2}$  inch or more in length taken in surface tow in March, April and May. In the northern part of our range, at least, the spawning season of the cod-fish is an exceptionally long one, extending usually from October to April although a few stragglers are frequently recorded both before and after this range of winter months. It is probable that the spawning act is gone through by a large part of a school simultaneously, the genital products simply mixing in the general flurry of the act, as chance may dictate.

The relative percentage of the sexes varies greatly from one school to another and from season to season, although if an average were to be struck it would probably be found not vastly different, with a likely tendency towards a slight preponderance of males. Cod-fish do not deposit the entire amount of their spawn at one time, but allow the eggs to pass out as they ripen, possibly throughout the entire season.

Temperature seems to be the chief factor in the breeding of cod and the optimum is not far from 40° F. The spawning fish feed little or none and those taken by anglers are in most cases either unripe or spent, if mature. Spawning generally takes place in water over 10 fathoms deep. The eggs float up to the surface on extrusion. They are nearly transparent and usually have a slight greenish hue. They vary from  $1\frac{1}{2}$  to  $1\frac{1}{3}$  mm. in diameter with an average half way between. At a temperature of about 40° F. the eggs hatch in about 17 days. During the latter part of the incubating period the specific gravity usually comes to exceed that of the sea water and the eggs consequently sink before hatching. They hatch into fry about 4 mm. long, which, for a time, drift at the surface. Just when they leave the surface for the bottom is uncertain very likely at the age of 2 months or so and length of about an inch. By summer the young cod have reached a size of from  $1\frac{1}{2}$  to 3 inches in length; the second summer a length of from 9 to 13 inches; the third about 18 inches and the fourth about 22 inches. The females usually reach maturity in the fourth year whilst the males may reach that period a year earlier. The number of eggs produced by a single cod is enormous. A fish 3 feet 3 inches long and weighing 21 pounds may have ovaries weighing 1 pound  $15\frac{3}{4}$  ounces, which have been estimated as holding 2,732,237 eggs. Seventy pound cod are recorded as producing over 9,000,000 eggs a season. When it is realized that the percentage that reach maturity about equals the parents the tremendous mortality rate for which nature allows is at once apparent.

**SIZE:** The largest on record was over 6 feet in total length and weighed 211 $\frac{1}{4}$  pounds. A 75 pound fish is a rarity, but those of 50 or 60 lbs. are not unusual.



#### 242. Haddock

*Melanogrammus aeglefinus* (Linnaeus)

**DISTRIBUTION:** Winter and spring, common off-shore and sometimes taken inshore to the eastward, uncommon to the westward, winter to May 14. *Woods Hole*, common off-shore sometimes taken inshore, March to May 14. *New York*, uncommon in winter.

Occurs in the North Atlantic on both coasts south to France and New Jersey, in deeper water to off Cape Hatteras.

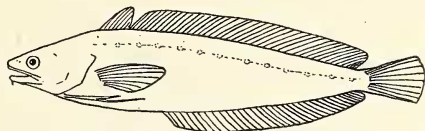
The habitat of the haddock corresponds closely to that of the cod, but it is a less adaptable fish, not extending quite so far north, quite so far south; into such shallow, or probably such deep water; or plentiful on such a variety of bottom. It is especially fond of the smooth areas between rocky patches, and also favors pebbly, gravelly, sandy, and certain types of clay bottom. It is more strictly a ground fish than the cod, and though it pursues the same schools of small fish, does not follow them to the surface. It is practically omnivorous, so far as the fauna where it occurs is concerned. The commoner mollusks, crabs, sea urchins and brittle stars are staples in its diet, and it must root out much of its food, such as burrowing mollusks and worms from the sea bottom, as pigs do. Haddock roam from place to place in search of food, and concentrate annually on their spawning grounds. Little is known of any migrations they may have beyond this, at least on the American coast.

**LIFE HISTORY:** Haddock seek more or less definite areas, often off shore banks, in between 20 and 100 fathoms of water, to spawn. They spawn from January to June producing eggs about  $1\frac{1}{2}$  mm. in diameter that are pelagic and very slightly agglutinous, at least when still young. A single female may extrude 100,000 to 2,000,000 eggs, according to size. Hatching takes place in 13 days at a temperature of  $41^{\circ}$  Fahr. The newly hatched larva is about 4 mm. long. The yolk sac is absorbed in about 10 days.

Young haddock live at the surface for three months or so, from 1 to 3 inches in length they have been taken associated with the red jellyfish (*Cyanea*). When 1 or 2 years old they are 5 or 10 inches long; when 4 or 5 years old 16 to 20 inches long; and they may spawn at a length of about 20 inches. They apparently reach a length of 2 feet when 7 to 9 years old, while spawning haddock feed very little, if at all.

**SIZE:** The usual size of the haddock is about 3 or 4 pounds more rarely up to about 17 pounds. The largest on record was 37 inches long and weighed  $24\frac{1}{2}$  pounds.

**243. Spotted Hake**  
*Phycis regius* (Walbaum)



Small anterior dorsal fin triangular, not ending in a filament.

**DISTRIBUTION:** Rather uncommon, mostly in the fall, September to December 18, also in the summer, May 19 to August. *Woods Hole*, uncommon, November, dredged in August. *Orient*, uncommon, November,

dredged in August. *Orient*, uncommon May 19 to August, sometimes common, September to early December. *New York*, uncommon, September to December 18.

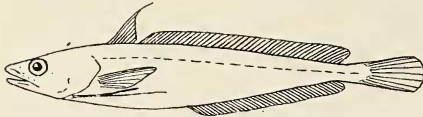
Occurs from Cape Cod (casually Halifax) south to Cape Fear, N. C., ranging from shallow water to a depth of 167 fathoms.

The young of the spotted hake may be found on the bottoms of rather deep, muddy bays at any season. Its principal food is various fishes (herrings, launce, etc.) and squid.

The reputed power of this species to give electric shocks is probably unfounded, as no well developed electric organs appear to be present, and there are no well authenticated records.

**LIFE HISTORY:** Found spawning in December (off the Carolinas).

**SIZE:** Reaches a length of about 18 inches.



244. **Boston Hake**  
*Phycis tenuis* (Mitchill)

Small anterior dorsal fin ending in a filament. Filamentous ventral fin not quite reaching anal. About 138 scales in a lengthwise series.

**DISTRIBUTION:** Abundant spring and fall, transient or winter resident to the westward, young taken throughout summer to the eastward. *Woods Hole*, abundant, especially in October and November, young common throughout the summer. *Orient*, September 25 to May 6. *New York*, uncommon, April to May, September to December.

Occurs from the banks of Newfoundland to Cape Hatteras, abundant northward in rather deep water, and recorded to a depth of 304 fathoms. A bottom-loving fish, frequenting muddy bottoms. Worms have been found in its stomach (*Woods Hole*).

The principal items in the hake's food appear to be shrimps and such comparatively soft crustacea, squid, and a variety of small fish. They have keen sight for any moving object, but appear to locate much of their food by swimming close to the bottom, the tips of their threadlike ventrals dragging, acting as tactile organs. Hake bite best at night and are doubtless more or less nocturnal or crepuscular in their feeding. In Camden harbor, Maine, after fishing for some time without a bite, a small one was taken at dusk, the light beginning to fade in the west. In the same locality they were, however, taken in the daytime, still at the time, the sky covered with low hanging clouds, thick outside.

**LIFE HISTORY:** Taken with ripe eggs in July (*Woods Hole*). Specifically unidentifiable larval *Phycis* (17 to 22 mm. total length) were sufficiently numerous at the surface of the ocean off Long Beach, Long Island, September 30, to be thrown on the beach by an on-shore wind. They had the appearance of other small surface fishes of the same size, as young bluefish,

larval mullet, etc., narrowly dark along the back, otherwise bright silvery, the silvery iris with a decided blue tinge.

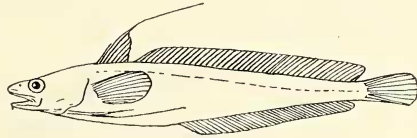
These would seem to have been the same as specimens of *P. tenuis*, 59 to 66 mm. standard (67 to 76 mm. total) length, just losing the silvery color, collected in shallow water at the shore, Shark River, New Jersey, May 26. Mr. Van Campen Heilner, the collector, reported them common at that date and gone shortly thereafter. Such specimens might easily be mistaken for *P. chuss*, as ventral filament reaches origin of anal, and scales are too little developed to be readily counted. Compared with *chuss* of the same size (49 to 65 mm. standard length) their ventral filaments are decidedly shorter, body decidedly deeper, head longer.

An individual  $8\frac{1}{4}$  inches total length has been taken in the shore waters of Long Island Sound at Duck Island, Connecticut, August 11. At about this size the hake is more or less a harbor fish, common in harbors of the Maine coast, taken at Camden in August from  $5\frac{1}{2}$  to 11 inches standard length. One of 8 inches had the following colors; above brown, sides brassy tinged with purple; belly and ventrals contrastingly white; iris dark brown with a pale inner thread; second dorsal and anal dark grey narrowly edged with dusky; caudal a little browner; first dorsal dark, its filament pale; a dark streak bordered on each side by pinkish white extending back below eye from center of upper jaw. In the 11-inch specimen especially, the brassy color of the sides also appeared in vague spots in the brown on the back.

Young are said to be taken at Woods Hole in summer at the surface under the eelgrass and gulf weed, but it may be suspected that these are another species, perhaps *P. regius*. The young of *P. floridanus* (related to *regius*) are common hiding in gulf weed off the east coast of Florida in early February, about  $1\frac{1}{2}$  inches in total length and matching the weed in color.

SIZE: Reaches a maximum length of about  $3\frac{1}{2}$  feet, weight 30 pounds.

245. **Squirrel Hake**  
*Phycis chuss* (Walbaum)



Small anterior dorsal fin tipped with a filament. Filamentous ventral fin reaching past front of anal. About 110 scales in a lengthwise series.

DISTRIBUTION: Abundant, probably resident, but most numerous May to June 26, October to December 31. *Woods Hole*, abundant May and June, again October and November, dredged July and August. *Orient*, uncommon spring and fall, occasionally in summer. *New York*, common, June 26. October to at least December 31, probably present at all seasons.

Occurs from the Gulf of St. Lawrence to Virginia and out to a depth of 300 fathoms.

FOOD: Feeds on shrimps, amphipods and other small crustacea, also small



fish (Woods Hole). In May and June they are common in Sandy Hook Bay and almost invariably distended with stomachs crammed with *Crangon* and similar crustaceans.

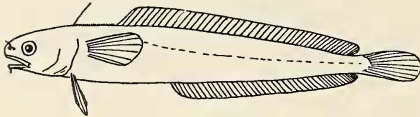
**LIFE HISTORY:** Spawns in summer. The eggs are buoyant, spherical, transparent, and about  $\frac{3}{4}$  mm. in diameter. Found with nearly ripe spawn in July; young, perhaps this species taken in tow, February to October, most abundant March to July (Woods Hole). If there is a silvery surface stage as in *P. tenuis*, the young assume adult characters and descend into deep water at a much smaller size.

"During the oceanographic cruise of the U. S. Fisheries Schooner *Grampus* in the summer of 1913, large quantities of the Giant Scallop were dredged at many points on the continental shelf between Nantucket Lightship and the Virginia Capes. In a number of instances these scallops were found to contain young examples of squirrel hake, *Urophycis chuss* (Walbaum), ranging in length from 27 to 70 mm. With one exception all were taken in the region between Montauk Point and Cape May, and within the 20 fathom curve. The only occurrence at a greater depth was in 42 fathoms, 52 miles S.S.E. from Montauk Point.

"Whether these young hake habitually live within the mantle cavity of the scallop, or whether they merely use it as a refuge on the approach of an enemy, is not known. The latter hypothesis appears to be the more plausible one. In the six dredge hauls in which young hake were thus taken, 27 examples were obtained from 59 scallops. In one instance, 11 hake were obtained from 9 scallops" (Welsh, *Copeia*, No. 18, 1915).

In late November the writer found comparable young (49 to 65 mm. standard length) rather common in about 20 fathoms of water off New York hiding in the mantle cavity of the scallop, as here described.

**SIZE:** Reaches a maximum length of 27 inches, weight 6 or 8 lbs. In May and June, in Sandy Hook Bay, females predominate, ripe or nearly so, which range from  $8\frac{1}{4}$  to 15 inches standard length, with an average of about  $9\frac{7}{8}$  inches.



246. **Four-bearded Rockling**  
*Rhinonemus cimbricus* (Linnaeus)<sup>15</sup>

**DISTRIBUTION:** Uncommon at Woods Hole, January to April 17, and young in tow net during June and July.

Dr. C. H. Townsend, dredging in Long Island Sound with the 'Fish Hawk,' between June 20 and July 2, 1914, records (Mss.) the rockling as very generally distributed from off Bridgeport and Smithtown Bay to off Larchmont at depths of from  $5\frac{1}{2}$  to 19 fathoms. At a somewhat greater

<sup>15</sup> The silvery rockling, *Gaidropsarus argentatus*, was recorded by Goode from Vineyard Sound. It is a far northern species and its occurrence in our region needs confirmation, especially in view of the little known silvery larval young of related fishes.



depth of 21 fathoms off Huntington Bay (a single haul) it was very abundant, at the same time he took the four-spotted flounder, shore eel-pout and silver hake in lesser numbers.

Occurs in the North Atlantic on both coasts, south to Narragansett Bay, and the latitude of Cape Fear in deep water along the continental slope.

A deep water bottom fish, known down to 724 fathoms, and uncommon inside the 25 fathom contour. Not a rock fish, found chiefly on soft bottom.

FOOD: Consists of shrimps, amphipods, bivalves, mollusks (Woods Hole).

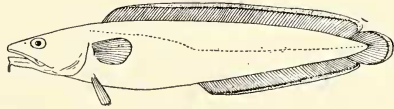
LIFE HISTORY: The young "mackerel midges" are silvery, unlike the adults in appearance, as in various other bottom fishes which have pelagic surface young.

Spawning takes place through the summer. The eggs are buoyant, about  $\frac{3}{4}$  mm. in diameter. Newly hatched larvae are slightly more than 2 mm. long. From about 5 to 10 mm. the larvae are characterized by very large black ventral fins, by the presence of one post-anal dark cross band, and by the short stocky body form. After a length of 17 to 20 mm. has been reached, the structure of the first dorsal fin can be made out. These larger fry are silvery, while still swimming at the surface.

SIZE: Reaches 10 inches in length (Woods Hole), and 16½ inches is reported from Scandinavian waters.

#### 247. Cusk

*Brosme brosme* (Müller)



DISTRIBUTION: Formerly not uncommon in April and May at Woods Hole, now very rare.

Occurs northward in the North Atlantic, south to Cape Cod (rarely New Jersey in deep water) and Denmark. The cusk is a solitary bottom fish occurring from 10 or 15 down to 500 fathoms (not so deep in American waters) and favoring rocky ledges or gravelly ground. It is a sluggish swimmer and probably wanders or migrates little if at all. A powerful fish, none the less, when hooked it coils about the line in a troublesome way.

FOOD: It feeds on crustaceans (such as crabs) mollusks, worms, and probably fish to some extent.

LIFE HISTORY: The spawning season is in spring and summer. More than 2,000,000 eggs have been counted in a female of medium size. The eggs are buoyant, 1.3-1.5 mm. in diameter, with a single oil globule of a brownish or pinkish color, and the entire egg surface finely pitted. The larvae are about 4 mm. long at hatching, the yolk is absorbed at about 5 mm. a week or so after hatching. As they grow the ventral fins elongate like those of young hake and young rockling, and become black, cusk larvae are separable from both of these by the independent ventral rays and presence of 3 black patches, one on top of the head, a second over the gut, a third at the tip of the tail, and 2 vertical black bands which divide

the trunk behind the head into 3 nearly equal sections. The young live near the surface, pelagic, until 2 inches or more long, becoming greenish yellow with blue eyes, not silvery like young rockling and Boston hake.

SIZE: Reaches a maximum length of 3 feet, and weight of about 30 pounds.

### THE GRENADIERS

Fishes found in deep water at the bottom, with broad angular heads, usually pointed snout, large eye, tail region elongate and ending in a point.



248. **Rat-tail**

*Macrourus bairdii* Goode and Bean

DISTRIBUTION: This abundant deep-sea fish which ranges to depths of over 1000 fathoms, has been dredged as a straggler in 9 fathoms of water, Vineyard Sound, August 26, 1882.

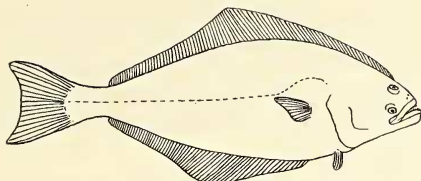
Occurs from the Gulf of St. Lawrence (rarely), south to the West Indies. A bottom fish usually found on soft mud, and a very feeble swimmer.

SIZE: Reaches a length of about 2 feet, usually about one foot long.

### FLOUNDERS.

Fishes with body flattened from side to side to lie on the bottom. The lower side is more or less (usually entirely) white or colorless, both eyes are on the upper side. Always a pectoral fin in the upper side.

- a. Ventrals symmetrical, similar in size, form and position; mouth large, symmetrical (see b).  
 Ventrals symmetrical; mouth small, twisted; eyes and color on the right side in our species (see d).  
 Ventrals unlike, that of the eyed side extended along the ridge of the abdomen. Eyes and color on the left side (see e).
- b. Sinistral,—eyes and color on the left side. *Paralichthys*  
 Dextral,—eyes and color on the right side (see c).
- c. Caudal fin lunate, anal rays more than 75. *Hippoglossus*  
 Caudal fin double truncate or rounded, its median rays longest. Anal rays fewer than 75. *Hippoglossoides*
- d. Lateral line with a distinct arch in front. *Limanda*  
 Lateral line without a distinct arch in front. *Pseudopleuronectes*
- e. Lateral line with a distinct arch in front. Scales smooth. *Lophosetta*  
 Mouth large.  
 Lateral line with a distinct arch in front. Scales rough. *Platophrys*  
 Mouth moderate.  
 Lateral line without distinct arch in front. Mouth very small. *Etropus*

249. **Halibut***Hippoglossus hippoglossus* (Linnaeus)

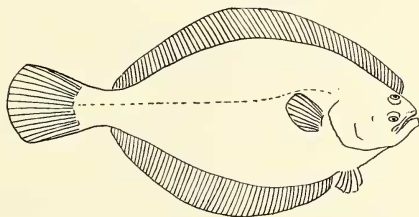
**DISTRIBUTION:** Rare in winter, to April, formerly not uncommon near Woods Hole. *Woods Hole*, rare, formerly not uncommon, a few taken regularly in April. *Orient*, one taken April, 1910, another several years previous to that. *New York*, occasional, winter.

Occurs in northern seas, circumpolar, southward, usually in deep water, to Sandy Hook on our coast. Though once common on the northern New England coast, the halibut is now practically fished out there.

**FOOD:** It is a voracious species preying chiefly on other fishes (cods, sculpins, grenadiers, herrings, launce, capelin, flounders a principal item, skates, wolf-fish, mackerel, etc.), also crabs and lobsters, clams and mussels, and even occasionally sea birds (alcidae). The halibut in tern is eaten by seals, and is a staple article of diet for the Greenland shark. Halibut sometimes rove the bottom in bands in search of food.

**LIFE HISTORY:** The halibut is believed to spawn in February on the eastern side of the Atlantic, ripe fish are reported from spring to early fall on the American side. The eggs of a fish of about 200 pounds have been estimated as over 2,000,000. They are between 3 and 4 mm. in diameter. Young halibut swim near the surface for some months after hatching and take to the bottom at a length of 4 or 5 inches or earlier. At 1½ inches, the larva is still pelagic and the upper eye has not completed its migration from the blind side.

**SIZE:** Reaches a total length of slightly over 9 feet and weight of about 700 pounds; but very rarely taken over 450 pounds.

250. **Sand Dab***Hippoglossoides platessoides* (Fabricius)

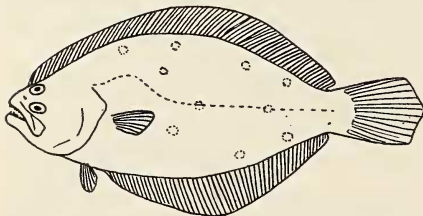
**DISTRIBUTION:** Uncommon at Woods Hole, February.

Occurs on both coasts of the North Atlantic, south to Cape Cod and Narragansett Bay. The sand dab occurs in moderately deep water, 10 fathoms or over. It avoids rocky or hard bottom on the one hand and very soft mud on the other, preferring a mixture of sand and mud. It usually lies on the bottom, but on occasion swims some distance up in the water, for just what reason we do not know.

**FOOD:** When larval at the surface it feeds first on diatoms, and on copepods as it grows larger and more active. Small ones on the bottom feed chiefly on shrimps and such small crustaceans; as they grow largere chino-derms (sea urchins and brittle stars) are an important item of diet, a great variety of invertebrates is eaten by the sand dab, and small fish occasionally caught by it.

**LIFE HISTORY:** Spawns in spring, from March to June in the Gulf of Maine, producing 30,000 to 60,000 eggs according to size. The eggs are buoyant, without oil globule, with a perivitelline space so broad that they are not apt to be confused with any other species, averaging about 2.5 mm. in diameter. Incubation occupies 11 to 14 days at a temperature of 39°, and hatching takes place when the larvae are 4 to 6 mm. long, the yolk being absorbed about 5 days later. The period occupied in larval growth varies with temperature; 3 or 4 months a fair estimate for the Gulf of Maine where the pelagic larvae have been taken from May to late summer. The eye commences its migration from the blind side when the larva is 20 to 35 mm. in length and metamorphosis is complete and it commences its life on the bottom at an estimated length of 1½ to 2 inches up to the time of its metamorphosis it lives pelagic, keeping close to the surface at first but sinking deeper as it grows. Like many other pelagic animals it sinks more or less regularly by day, to rise toward the surface again at night. The growth of the sand dab varies with the temperature of the water. It takes some 3 to 5 years to reach a length of 12 inches, some become sexually mature when only 6 inches long, probably all do so by their third year, and an age of 24 to 30 years may be reached.

**SIZE:** Reaches a length of about 2 feet and weight of 7 pounds.



251. **Summer Flounder**  
*Paralichthys dentatus* (Linnaeus)<sup>16</sup>

Without definite large dark ocellated spots. 15 or 16 gill-rakers on the lower limb of the first arch.

**DISTRIBUTION:** Abundant in summer, April 16 to December 27. *Woods Hole*, abundant, May 10 to October 15. *Orient*, common, April 16, 1913 (average April 28) to December 27, very early and very late ones of large size. *New York*, abundant, May 7 to November 21.

Occurs from Cape Cod (casually Casco Bay) to South Carolina (perhaps Florida). Is found in shallow inshore waters and bays in summer, in the northern part of its range moving out into deeper water in winter.

<sup>16</sup> The closely related southern flounder, *Paralichthys lethostigmus*, with about 10 gill-rakers versus 15 or 16, has been recorded from New York, very likely in error.



Generally distributed, particularly numerous on sandy bottoms, also found on mud and among eel grass. It takes it but an instant to bury itself in the sand where it is frequently seen lying covered all but the eyes.

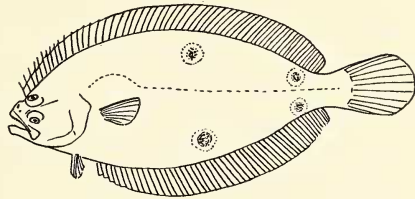
**FOOD:** Feeds on crustacea, particularly shrimps and crabs, worms, squid, small mollusks and to a considerable extent on small fishes which it sometimes pursues right up to the surface.

**LIFE HISTORY:** A spent female seined on June 21. Young, 2 to 6 inches in standard length, frequent near shore in the summer months.

**SIZE:** Has reached a weight of 26 pounds and estimated length of 46 inches, and one taken off Fishers Island about 1915 by an Orient beam-trawler, weighed 30 pounds. Average run of fish, 2 to 5 pounds. In Sandy Hook Bay they average between 12 and 15 inches in length.

### 252. **Four-spotted Flounder**

*Paralichthys oblongus* (Mitchill)



Four large dark ocellated spots on the colored side, one pair in the neighborhood of the middle of the body. and another pair closer together, placed more posteriorly.

**DISTRIBUTION:** Common to the eastward in summer and fall, May 18 to December 12, also to the westward in somewhat deeper water. *Woods Hole*, common in May and June, most abundant about June 1. *Orient*, uncommon, May 18 to December 12. *New York*, common in rather deep water (November). One (casual) in Sandy Hook Bay on June 2, 1925.

Occurs on the coasts of southern New England (casually north to Gloucester, Mass.) and New York, on sand and mud bottom usually in from 7 to 17 fathoms.

Dr. C. H. Townsend, dredging in Long Island Sound with the U. S. S. *Fish Hawk* between June 20 and July 2, 1914, records (Mss.) frequent captures of the four-spotted flounders at depths of from 6 to 21 fathoms. At the same time he took a few silver hake and shore eel-pout, and the rockling in greater numbers.

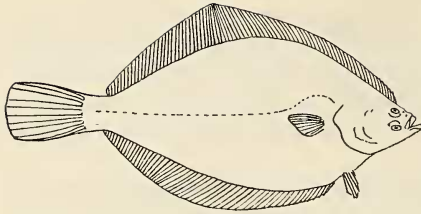
**FOOD:** Feeds on small crabs, shrimps and other small crustacea, annelids, mollusks and small fish (*Woods Hole*).

**LIFE HISTORY:** The spawning season of this species is at its height in May in the northern part of our territory. Buoyant non-adhesive eggs about 1 mm. in diameter are extruded and hatch in about eight days at a temperature of about 53° F.

Young of 2 to 3 inches have been taken at *Woods Hole* in autumn, showing that this flounder takes to the bottom about 3 months after hatching.

**SIZE:** Reaches a total length of 15 inches, weighing 13 ounces (*Orient*).





253. **Rusty Dab**  
*Limanda ferruginea* (Storer)

**DISTRIBUTION:** Common resident in rather deep water. *Woods Hole*, common throughout the year at depths of 10 to 12 fathoms, a few along shore. *New York*, common in rather deep water (November).

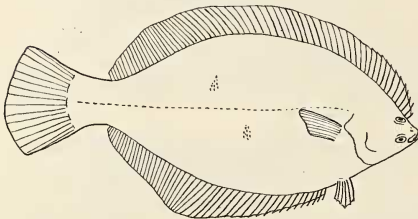
Occurs from Labrador to New Jersey. Partial to sandy bottoms.

The rusty dab is found on sandy or mixed sand and mud bottoms at moderate depths, 5 to 50 fathoms.

**FOOD:** Various small crustacea, also annelids, mollusks and small fishes. Fish in breeding condition usually are empty.

**LIFE HISTORY:** Spawns in spring and summer, the individual females spawning over a considerable period of time. The eggs are buoyant, without oil globule, spherical, very transparent, with a narrow perivitelline space, about 0.9 mm. in diameter. The surface of the egg is covered with very minute striations, and the germinal disk is of a very pale buff color. Hatching takes place in 5 days at a temperature of 50° to 52°. Larvae of 11 mm. are still symmetrical, at 14 mm. metamorphosis is under way, and presumably the pelagic life of this species is short compared to that of some other flounders.

**SIZE:** Reaches a length of 21¾ inches.



254. **Winter Flounder**  
*Pseudopleuronectes americanus*  
(Walbaum)

**DISTRIBUTION:** Abundant resident. *Woods Hole*, abundant resident. *Orient*, abundant from October to May; uncommon in summer, but more common in deep water. *New York*, abundant resident.

Occurs from Labrador to Georgia.

Found on all sandy or muddy bottoms, from the shore (at all seasons) to at least 20 fathoms (in fall). Mud broken by patches of eel grass is perhaps the favorite ground, but it is common enough on sand and even pebbly bottom. It sometimes lies buried in the mud, all but the eyes, and spends most of its time lying motionless, but can dash for a few yards with surprising rapidity, when disturbed, or to seize some luckless shrimp. In-

dividuals living on the flats are usually quiescent over the low tide and become more active on the flood, moving about in search of food.

Sailing across some flats in a light air with every detail of the bottom in a very few inches of water plainly visible, it was interesting to note the behavior of small flounders which darted swiftly away for a very short distance and then settled motionless on the bottom. Unlike animals which are in like manner protected by concealment usually behave thus, for instance the woodcock which flies a short distance and settles again on the brown leaves.

Flounders run very early in the spring in the vicinity of New York and are the first fish caught by rod-and-line anglers from the city. They are abundant in most of our shallow or muddy bays and accessible to many who have no chance to angle for other species.

This species moves off shore to some extent to find deeper cooler water in summer, but is rather common even in the shallow bays and in the warmer months. About August 1, 1917, there was an unusually heavy mortality of *Pseudopleuronectes americanus* in Moriches Bay, Long Island, N. Y. This is a broad, almost tideless bay, but much of it is very shallow (extensive flats having but a few inches of water) and it is decidedly brackish. The channels coming in from the west through the narrows which separate this from Great South Bay, are salt enough, but some of the landward spring-fed "creeks" are pure fresh water, and the water on the seaward side, under the beach, which separates bay from ocean, is surprisingly fresh. This condition is probably due to the fact that the opening of these waters to the ocean is twenty-five miles west at the farther end of Great South Bay, namely Fire Island Inlet.

*Pseudopleuronectes* is one of the few marine fishes found in the bay in numbers. An exceptional number of dead of this species were noticed on July 28, and on August 4 it was estimated that a thousand dead were seen. They averaged about 8 or 9 inches in total length. This high mortality was probably correlated with a period of unusually hot weather which that section had just experienced. It also should be borne in mind that this is a northern fish, which, though it extends to Chesapeake Bay and beyond, is less numerous, especially in summer, south of New York. Similarly, large numbers of winter-killed *Cyprinodon variegatus* have been seen on Long Island, a fish whose range is southern and extends northward only to Cape Cod.

Unfortunately no data is accessible as regards the temperature which accompanied the mortality of flounders, except the recollection that the locality was, more than it usually is, affected by the heat-waves then present. Data for July and August, 1917, at New York City, kindly furnished by the local office of the United States Weather Bureau gives an idea of the date and severity of these heat-waves. The mean daily temperature was above 75° on July 2 (77); again on July 16 to 17 (76, 78); on July 20 to 27 (76, 76, 76, 78, 78, 77, 78, 82); July 30 to August 2 (85, 89, 89, 84); August 7 (78); August 9 (78); August 13 (76); August 15 (76);

August 17 (77); August 20 to 21 (76, 76); August 24 (76); August 29 (76).  
—*Copeia*, No. 55.

Winter flounders taken on the coast of Maine in August had numerous small pinkish amphipod 'lice' (*Lafystius sturionis*) crawling on their upper surfaces, notably about the head and shoulders, and particularly the larger, fish, something which does not seem to have been noticed in flounders south of Cape Cod.

FOOD: Feeds on shrimps and other small crustaceans, annelids, mollusks, squid, and small fishes. Red sea weed recorded as a food (Woods Hole).

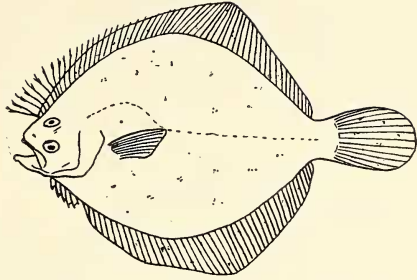
LIFE HISTORY: The winter flounder is a winter breeding fish, spawning usually at the coldest time of the year in rather shallow places of low salinity (often from one to two fathoms). December to March covers the bulk of the spawning. During this time they feed very lightly which fact accounts for the failure of anglers to catch them at this season in quantities. Examination of large quantities of spawning flounders failed to reveal more than mere traces of food.

In the latitude of New York City, angling stops about the middle of December and begins again in the latter part of February, while in New England the off season is from about November to March.

Individual females produce about 500,000 eggs annually and nearly 1,500,000 have been taken from a large one of  $3\frac{3}{8}$  pounds.

In confinement at least the spawning act is invariably performed at night, usually between 10:00 P.M. and 3:30 A.M. The eggs are minute, adhesive and heavy. They vary in diameter from .71 to .86 mm. The blastodisc is large and of a bright amber color whilst the yolk is colorless. On account of their adhesive nature they compress each other into more or less regular polyhedrons. The incubation is slow, the eggs not hatching in less than 15 days at a temperature of 39° F. Very little motion of the embryo was noticeable at any time. The eggs of this, as well as all other flounders, hatch into perfectly symmetrical fishes which swim in a normal position. On hatching, the larval winter flounder measures about 4 mm. in length. At the end of twenty-two days they are still perfectly symmetrical. They are pigmented with light yellow chromatophores which become darker as time wears on. The metamorphosis is said to be rapid and to take place at a length of about 8 or 9 mm. By the middle of the following summer these larvae have turned over on their side and one eye has passed round to the other side of the head and the typical asymmetrical form of the adult is attained. These little fishes are frequently taken in seines and may have a length of 30 or 40 mm. Maturity is probably reached in about the third year.

SIZE: Though there is a record of a 20-inch winter flounder weighing 5 pounds it is very rare to find them over 15 inches long and  $1\frac{1}{2}$  pounds in weight, particularly in our region, for large ones are more frequent on the coast of Maine. There is a record of one of 3 pounds from near Glen Cove, Long Island, March 30, 1923, which measured  $17\frac{3}{4}$  inches total length. (L. B. Hunt, Jr.)

255. **Sundial***Lophopsetta maculata* (Mitchill)

**DISTRIBUTION:** Rather common, March 1 to December 18, rare in winter. *Woods Hole*, common, April to late autumn. *Orient*, resident, rare in winter, rather common March 1 to December 17. *New York*, rather common, spring to December 18.

Occurs from the Gulf of St. Lawrence to South Carolina, rare north of Cape Cod.

In our region almost always found on sandy bottoms in both shallow water (sometimes stranded on sand bars by the falling tide); and deep water (17 to 20 fathoms). On Georges Bank it occurs at depths of 30 or 40 fathoms.

The flesh of the sundial is translucent and when held to the light a shadow may be seen passing through the fish. In spite of this fact it is one of our most delicious species—yet, on account of its comparative scarcity and small size it probably will never be widely known as a table-fish.

**FOOD:** Feeds on crustacea (*Crangon* and miscellaneous shrimps, crabs, etc.), worms, mollusks, etc., and small fishes (*Ammodytes*, small herring, silversides, etc.) and squid.

**LIFE HISTORY:** In Massachusetts this species spawns in May and June. The eggs are spherical, transparent buoyant and non-adhesive, with a single colorless or pale yellow oil globule and the surface of the egg showing faint irregular markings. They average about 1 mm. in diameter and hatch in about eight days at a temperature of about 53° F. At about 10 mm. the migration of the eye from the blind side is completed and the fry ready to take to the bottom.

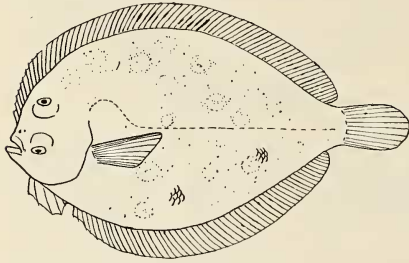
Young, 1 to 2 inches total length taken mid-December (*Orient*). They have been described from Rhode Island waters as 2 or 3 inches long in July and 4 inches and upward in December. Probably an average of 6 to 9 inches is reached by the end of the second summer and 10 to 12 inches the third summer when the fish are mature.

In Sandy Hook Bay there is one group which shows an average growth of from 20 mm. in standard length in May to 50 to 60 mm. in the latter part of September. Another group, probably of the next year, grows from about 90 to 110 mm. ( $4\frac{3}{8}$  inches) between the middle of July and the middle of September. It would seem from this that they spawn earlier here than to the east, although ripe females have been taken as late as May 8. If the



20 mm. fish of that month are of the preceding year, their growth has been remarkably slow. Of course we may have gotten only laggards in the bay.

SIZE: Reaches 15 inches total length, 1 pound weight (Orient), or a maximum of 18 inches, and weight of 2 pounds, but usually only 10 or 12 inches.



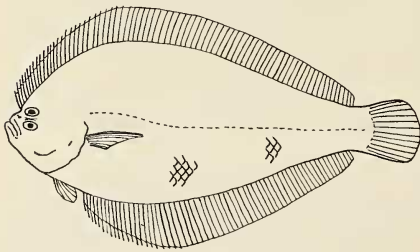
**256. Eyed Flounder**

*Platophrys ocellatus* (Agassiz)

DISTRIBUTION: Casual in fall, September to October 20. *Woods Hole*, several specimens, October 4 to 20, 1906. *New York*, accidental, September.

Occurs on sandy shores of the western Atlantic from Long Island to Rio.

SIZE: Reaches a length of about 8 inches.



**257. Small-mouthed Flounder**

*Etropus microstomus* (Gill)

DISTRIBUTION: *New York*, at times not uncommon, recorded from July 26 to October 19, 1923 (Sandy Hook Bay), October 21, 1925 (Rockaway Inlet).

Due to uncertainties of identification, it is impossible to say where this species (doubtless often overlooked) occurs most abundantly.

It is a small, fragile, sinistral flounder; head small; mouth small, symmetrical, oblique; eyes close together; scales rather large, deciduous. Translucent, the vertebral column showing through as a dark, lengthwise streak, with sometimes a few dark marks along it, the only tangible pattern in a brownish grey finely freckled upper surface.

Previous to 1923 the small-mouthed flounder was represented in our field notes by a single record from Sandy Hook Bay (September 28, 1921). During that year it became quite common on a certain stretch of beach in the "Bight of the Hook."



The following growth table was compiled from specimens taken in that year:

Date		Average Standard Length	
July	26, 1923	62	mm.
August	2, "	70	"
"	9, "	74	"
"	23, "	78	"
"	30, "	82	"
September	6, "	88	"
October	9, "	82.5	"
"	19, "	84	"

SIZE: Reaches a maximum length of about 6 inches.

### SOLES

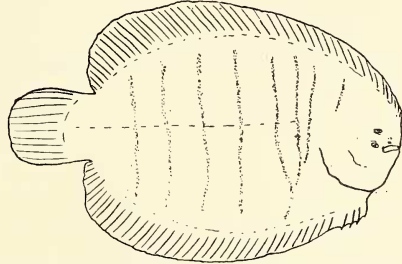
The most specialized, or degenerate, flatfishes. Eyes very small, mouth small and very crooked. Our species has no pectoral fin on the upper, eyed, colored side.

Dextral, scales well developed, rough.

Dextral, no scales.

*Achirus*  
*Gymnachirus*<sup>17</sup>

#### 258. American Sole *Achirus fasciatus* Lacépède



DISTRIBUTION: Common to the westward from April to December, uncommon to the eastward. *Woods Hole*, uncommon, taken throughout the year. *Orient*, common in shallow bays, May to October 15. *New York*, common, April to December. Rare in *Sandy Hook Bay*.

Occurs from Cape Ann to the Gulf Coast. Sandy and muddy bottoms in shallow, and running into brackish waters.

FOOD: Rock weed and eelgrass recorded as food in August (*Woods Hole*).

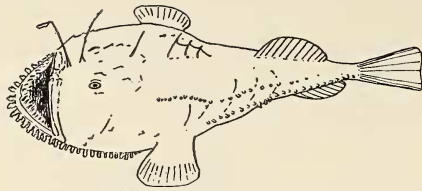
LIFE HISTORY: Eggs apparently rise in latter part of May (*Woods Hole*).

SIZE: Reaches about 6 inches standard length (*Sandy Hook Bay*).

### ANGLERS

Large depressed scale-less fishes, tadpole-shaped with big heads and narrow tails. Mouth enormous, armed with irregular, formidable, pointed backwardly directed teeth. Pectoral fins on short arm-like bases.

<sup>17</sup> The naked sole, *Gymnachirus nudus*, described from *Bahia, Brazil*, is reported as accidental at *Woods Hole*, October 16, 1906. If the genus is correct, the species is in doubt. *Gymnachirus melas* has been more recently described from *Carolina*.



259. Angler  
*Lophius piscatorius* Linnaeus

**DISTRIBUTION:** Common resident to the eastward, winter only to the westward, except for a few in deep water. *Woods Hole*, large specimens common in summer and fall. *Orient*, adults in June and July. *New York*, common, October to May 19, a few summer in moderately deep water.

Occurs from Norway and the Gulf of St. Lawrence south along shore to Cape Hatteras and in deep water outside the continental shelf to the West Indies and Cape of Good Hope.

Large anglers sometimes allow themselves to become stranded in shallow water in late fall. These would seem to be aged individuals tired of life in the ocean depth, that have come up to the shore to die. Their bleached jawbones with formidable teeth are frequently picked up along the beaches.

**Food:** Indiscriminately carnivorous, eating skates, flounders, weakfish, sea robins, butterfish and other smaller fish, squid and other mollusks, crabs and smaller crustacea, annelids, etc., diving birds.

Bigelow and Welsh say "In Scottish waters, where the habits of this species are better known than in the Gulf of Maine, its local abundance depends on the supply of small fish, and in spite of their poor ability as swimmers goosefish have been found to congregate near particular shoals of herring. W. F. Clapp, who has often watched the feeding habits of goosefish at low tide in Duxbury Bay, Mass., where they are very plentiful, describes them to us as lying perfectly motionless among the eelgrass with the tag or "bait" on the tip of the first dorsal ray swaying to and fro over the mouth, either with the current or by some voluntary motion so slight as to be invisible. The only fish he has seen them take are tomcod, and when one of these chances to approach it usually swims close up to the "bait" but never (in his observation) actually touches it for as soon as the victim is within a few inches the goosefish simply opens its vast mouth and closes it again, engulfing its victim instantaneously. These observations are the more welcome as no other recent student seems to have seen the feeding habits of this species in its natural surroundings, and they show that it depends mostly on such fish or Crustacea as chance to stray close enough to be snapped up from ambush or siezed by a sudden rush. However, the fact that it has been known to seize and swallow hooked fish as the latter were being hauled up, and even to capture sea birds sitting on the surface, proves that it may make considerable excursions for a meal on occasion."

**LIFE HISTORY:** Spawns from May to August. Spawn laid in clusters which are often found attached to fish traps or floating in the Sound (*Woods Hole*).

The eggs are extruded in summer. They form in gelatinous masses violet gray or purplish-brown in color, floating at the surface. These may be as large as a foot or two in width and 30 or 40 feet in length with weight of over thirty pounds.

The eggs, which have been estimated as  $2\frac{2}{3}$  millions for a single female, are spherical or slightly oval about  $2\frac{1}{3}$  mm. in diameter. The larvae are about 4.5 mm. long at hatching, and float at first with the yolk uppermost. The absorption of the yolk and formation of the mouth are complete and the larva rights itself in the water in about 2 weeks. It grows to 50 mm. while still free swimming, and descends to the bottom shortly thereafter; as the fins develop and the head enlarges various picturesque stages having been passed through. The species is mature at a length of 30 inches or more and probable age of upwards of 4 to 8 years, the growth rate varying in different waters.

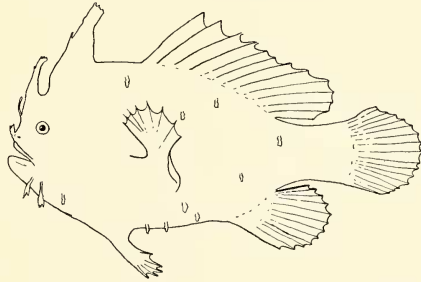
**SIZE:** Reaches a length of 3 or 4 feet, weighing up to 45 pounds, and recorded as heavy as 70 pounds.

### FROGFISHES

Small, sluggish fishes of irregular outline, hiding in weed. Mouth large and oblique. Pectoral fins on short arm-like bases. Body scale-less. Color usually spotted and streaked, to render the fish inconspicuous.

#### 260. *Sargassum Fish*

*Histrio histrio* (Linnaeus)



**DISTRIBUTION:** Rare and irregular to the eastward, accidental to the westward, July to November. *Woods Hole*, rare and irregular, July to November. *New York*, accidental, August.

Occurs in tropical parts of the Atlantic, north to Cape Hatteras and occasionally beyond. Confined almost exclusively to floating drifting gulf weed off shore; where its shape and color give it a very low visibility.

**LIFE HISTORY:** Has deposited unfertilized spawn in laboratory aquaria, in jelly masses, similar to those of *Lophius*.

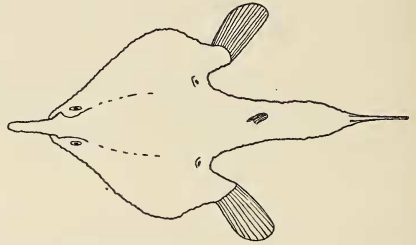
**SIZE:** Reaches a length of about 6 inches.

## BATFISHES

Small, sluggish, bottom fishes, hard exterior studded with small tubercles. Body depressed, triangular forward to the snout which is more or less pointed and produced. Pectoral fins at the side on backwardly directed angles of the broad anterior part of the body. The tail portion narrower ending in a weak squarish or rounded caudal fin.

261. **Batfish**

*Ogcocephalus vespertilio* (Linnaeus)



**DISTRIBUTION:** *New York*, accidental, mid-summer.

Occurs in the West Indian fauna, regularly north to Florida.

**SIZE:** Reaches a length of about 9 inches.

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\* Species marked with asterisks we consider as very doubtful records. They are not included in the list proper, being mentioned only in footnotes, and are not figured.